Programme of IAU Symposium 365

Time	Author(s)	Title	In-**P**erson/ **V**irtual
Monday, 21 August			
08:45–09:30	**Registration of participants**		
09:30–10:00	**Opening ceremony**		
Session 1. Solar and Stellar Convection			
Chair: Sami Solanki			
10:00–10:30	Aaron Birch	Spectra of large-scales flows on the Sun *(invited talk)*	P
10:30–11:00	Petri Käpylä	Subadiabatic convection and overshooting in deep convection zones *(invited talk)*	V
11:00–11:30	**Coffee break**		
Chair: Ulysses Sofia			
11:30–12:00	Youhei Masada	Modeling Convection and Transport in the Sun *(invited talk)*	P
12:00–12:15	Irina N. Kitiashvili, A.G. Kosovichev and A. A. Wray	3D Radiative Hydrodynamic Modeling of Shallow Convection Zones of Main-Sequence Moderate-Mass Stars	V
12:15–12:30	Christopher Hanson, S.B. Das, P. Mani, S. Hanasoge and K.R. Sreenivasan	Helioseismic imaging of supergranules reveals new insight into solar convection	V
12:30–12:45	Quentin Noraz, A.S. Brun and A. Strugarek	Impact of the Nusselt number on the energy distribution among solar convection scales	V
12:45–13:00	Nathan Kleeorin and I. Rogachevskii	On the nature of turbulent convection in the sun and stars: laboratory experiments, theory and mean-field simulations	P
13:00–14:30	**Lunch**		
Chair: Laurent Gizon			
14:30–14:45	Yukun Luo, J. Jiang and R. Wang	Analyzing supergranulation and its variations over solar cycles 23 and 24 based on magnetic power spectra	P

14:45–15:00	Xavier Haubois	Imaging stellar surface features with optical interferometry	P
15:00–15:15	Teresa A. M. Braun	Applying the Kuhfuss Convection Theory to Convective Envelopes	P
Session 2. Differential Rotation and Meridional Circulation			
Chair: Laurent Gizon			
15:15–15:45	Alexei A. Pevtsov, Yu.A. Nagovitsyn and L. Upton	The Sun's Large-Scale Flows: differential rotation and meridional circulation *(invited talk)*	P
15:45–16:15	S.P. Rajaguru	Meridional Circulation in the Solar Convection Zone: Reconciling Helioseismic Measurements *(invited talk)*	P
16:15–16:45	**Coffee Break**		
Chair: Ilan Roth			
16:45–17:00	Marianne Faurobert, T. Corbard, B. Gelly, R. Douet and D. Laforgue	Rotational shear in the low photosphere of the Sun	P
17:00–17:15	Sushanta C. Tripathy, K. Jain, S. Kholikov, and R. Komm	Probing the Sun's Near Surface Shear Layer using HMI Spherical Harmonic Coefficients	V
17:15–17:30	Leonid L. Kitchatinov	Near-surface shear layer of solar rotation: origin and significance	V
17:30–17:45	Arnab Rai Choudhuri and B.K. Jha	A theoretical model of the near-surface shear layer of the Sun	V
17:45–18:00	Maria Camisassa and N.A. Featherstone	The Transition from Solar-like to Antisolar Differential Rotation: A Geometric Interpretation	P
18:00–18:15	Alexander V. Getling and A.G. Kosovichev	Superrotation of the pattern of convective structures at various depths in the solar subphotospheric zone	P
18:15–18:30	Irina N. Kitiashvili, A.G. Kosovichev, A.A. Wray and V.M. Sadykov	Fine Structure of Differential Rotation and Meridional Flows in the Near-Surface Shear Layer of the Sun from 3D Radiative Hydrodynamics Simulations	V
19:00–21:00	**Welcome Reception**		
Tuesday, 22 August			
Chair: Alexei Pevtsov			
9:00–9:15	Alexander G. Kosovichev	Properties of Inertial Oscillations and Rossby Waves in Solar and Stellar Convection Zones	V
9:15–9:30	A.S. Kutsenko, V.I. Abramenko and D.V. Litvishko	The rotation rates of solar active regions as a constraint for the global dynamo models	V
9:30–9:45	Ruizhu Chen and J.-W. Zhao	Frequency-dependent Measurements of the Sun's Interior Meridional Circulation	P

9:45–10:00	Sushant S. Mahajan, X.-D. Sun and J.-W. Zhao	Removal Of Active Region Inflows Reveals a Weak Solar-cycle-scale Trend In Near-surface Meridional Flow	V
10:00–10:15	Sushant S. Mahajan, D. Nandy and Petrus C. Martens	Lenz's Law at Work in the Solar Interior: Interplay of Magnetic Tension and Differential Rotation	V
10:15–10:30	Dibya Kirti Mishra, S. Routh, B.K. Jha, S. Chatterjee and D. Banerjee	Differential Rotation of the Solar Chromosphere using multidecadal Ca K spectroheliograms	P
10:30–10:45	Yash Mandowara, Y. Bekki and L. Gizon	Observational study of Reynolds stresses associated with solar inertial modes	P
10:45–11:00	A. Araújo and Adriana Valio	Differential rotation of stars from spot transit mapping: dependence on rotation period and effective temperature	P
11:00–11:30	**Coffee Break**		
Session 3. Global dynamo. Solar and Stellar Activity Cycles *Chair: Andrey G. Tlatov*			
11:30–12:00	Gustavo Guerrero	Advances in global simulations of solar and stellar dynamos *(invited talk)*	V
12:00–12:30	Bidya Binay Karak	Recent Developments in the Babcock–Leighton Solar Dynamo Theory *(invited talk)*	P
12:30–13:00	Dipankar Banerjee	Solar-cycle observed patterns as revealed from Kodaikanal multi wavelength archive *(invited talk)*	P
13:00–14:30	**Lunch**		
Chair: Ruizhu Chen			
14:30–15:00	Jie Jiang	Nonlinear and stochastic mechanisms of the solar cycle and their implications for the cycle prediction *(invited talk)*	P
15:00–15:30	Dibyendu Nandy	Predicting the Solar Cycle: Progress made and Lessons Learnt *(invited talk)*	V
15:30–15:45	Chitradeep Saha, S. Chandra and D. Nandy	The Sun's slumber is not so deep when it goes to sleep!	P
15:45–16:00	Zebin Zhang and J. Jiang	A Babcock–Leighton-type Solar Dynamo Operating in the Bulk of the Convection Zone and its Application to Solar-type Stars	P
16:00–16:30	**Coffee Break**		
Chair: Aaron Birch			
16:30–16:45	Valery V. Pipin	Doubling dynamo-wave frequency on fast rotating solar analogs?	V

16:45–17:00	K.M. Kuzanyan, N. Kleeorin, I. Rogachevskii and N.T. Safiullin	Magnetic helicity generation, its flux in the solar convective zone and the solar activity cycle	P
17:00–17:15	Dmitry D. Sokoloff, E.V. Yushkov and A.Yu. Serenkova	Resonance and stellar dynamos	P
17:15–17:30	Vindya Vashishth, B.B. Karak and L. L. Kitchatinov	Modelling the long-term variability of sun-like stars: From subcritical to supercritical dynamos	P
17:30–17:45	Valentina I. Abramenko, R.A. Suleymanova and A.V. Zhukova	Insight into the global dynamo operation from the two recent solar cycles of space-based observations	V
17:45–18:00	Regina A. Suleymanova and V.I. Abramenko	Manifestations of the turbulent component of the global solar dynamo in the minima of solar activity	V
18:00–18:15	Akash Biswas, B.B. Karak and R. Cameron	The role of nonlinear toroidal flux loss due to flux emergence in the long-term evolution of the solar cycle	P
18:15–18:30	Egor A. Illarionov and R. Arlt	Two solar minima in the light of reconstructed historical observations	P
18:30–18:45	Pawan Kumar, B.B. Karak and V. Vashishth	Solar cycle variability induced by stochastic fluctuations of BMR properties and at different amounts of dynamo supercriticality	P
Wednesday, 23 August			
Session 4. Helioseismology and Asteroseismology			
Chair: Mustapha Meftah			
9:00–9:30	Alexander G. Kosovichev, S.G. Korzennik and V.V. Pipin	Helioseismic Observations of Solar Torsional Oscillations and Evidence for Dynamo Waves *(invited talk)*	V
9:30–10:00	Ruizhu Chen	Recent Progress in Time-distance Helioseismology: Meridional Circulation, Far-side Imaging, and Sunquakes *(invited talk)*	P
10:00–10:30	Laurent Gizon	Inertial modes as probes of solar convection *(invited talk)*	P
10:30–11:00	Savita Mathur	Convection, rotation, and magnetic activity of solar-like stars from asteroseismology *(invited talk)*	V
11:00–11:30	**Coffee Break**		
Chair: Dipankar Banerjee			
11:30–11:45	Matthias Waidele and J.-W. Zhao	Solar Rossby waves and their dependence on the solar cycle	P
11:45–12:00	Jordan Philidet and L. Gizon	A 2D model for the excitation of the linearly stable solar inertial modes by turbulent convection	P
12:00–12:15	Angel Martínez and A.C. Donea	Anisotropic seismic ripples from deep locations of seismic sources	V

12:15–12:30	Guifang Lin, Y. Li, T. Wu and S. Jie	The influence of small-scale magnetic fields in the photosphere on surface effects for KIC 11295426 and KIC 10963065	P
12:30–12:45	Ana Brito and I. Lopes	The effect of Coulomb interactions on acoustic oscillations in the outer layers of low-mass stars	P
12:45–13:00	Yuqing Lou	Solar/Stellar Rossby Waves and Tidal Waves in Their Surface Layers	P
13:00–14:30	**Lunch**		
Chair: Nadezhda Zolotova			
14:30–14:45	Savannah Perez-Piel, J.C. Buitrago-Casas, J.C. Martíinez Oliveros and C. Lindsey	Identifying Submerged Acoustic Sources	V
14:45–15:00	David E. Mkrtichian and A.P. Hatzes	Acoustic tomography of the atmosphere of roAp star Alpha Circini	P
15:00–15:15	Biji Lekshmi, L. Gizon1, K. Jain, Z.-C. Liang and J. Philidet	Temporal variations of solar inertial mode parameters	P
15:15–15:45	**Coffee Break**		
16:00–22:00	Visit to the Byurakan Astrophysical Observatory		

Thursday, 24 August

Session 5. Local Processes of Magnetic-Flux Emergence. Sunspot and Starspot Formation

Chair: Alexander Getling

9:00–9:30	Sami Solanki, Y.C. Unruh and A.S. Shapiro	Some recent results on sunspots and starspots *(invited talk)*	P
9:30–10:00	Valentina I. Abramenko	Signature of local (turbulent) dynamo on middle and small scales *(invited talk)*	V
10:00–10:15	Alexander G. Kosovichev	Large-scale Subsurface Flows Associated with Solar Emerging Active Regions	V
10:15–10:30	John T. Stefan and A.G. Kosovichev	Helioseismic Measurement of Subsurface Magnetic Field Characteristics in Developed Sunspots	P
10:30–10:45	Spiridon Kasapis, I.N. Kitiashvili, A.G. Kosovichev, J.T. Stefan and B. Apte	Early Detection of Active Region Emergence in the Solar Interior Using Acoustic Power Maps and Machine Learning Data Analysis	P
10:45–11:00	Anu B. Sreedevi, B.K. Jha, B.B. Karak and D. Banerjee	Observational study of bipolar magnetic regions: Support of thin-flux tube rise model?	P
11:00–11:30	**Coffee Break**		
Chair: Youhei Masada			

11:30–12:00	Maarit J. Korpi-Lagg, J. Warnecke and M. Rheinhardt	Interaction of different dynamo instabilities in the convection zones of solar-like cool stars: role for magnetism and dynamics *(invited talk)*	V
12:00–12:30	Lisa A. Upton, I. Ugarte-Urra and B.K. Jha	The Dynamics of Magnetic-Flux Emergence: Sunspot Formation and Evolution *(invited talk)*	V
12:30–12:45	Tanayveer Singh Bhatia, R. Cameron, H. Peter, S. Solanki, D. Przybylski, V. Witzke and A. Shapiro	Small-scale dynamos in cool stars: magnetic field structure and changes in lower photospheres of F3V to M0V stars	P
12:45–13:00	Bibhuti Kumar Jha, A.B. Sreedevi, B.B. Karak and D. Banerjee	Exploring Sun's Bipolar Magnetic Region Tilts and the Phenomenon of Tilt Quenching through Magnetic Field Dependence	V
13:00–14:30	**Lunch**		
Session 6. Miscellaneous *Chiar: Dmitry Sokoloff*			
14:30–15:00	Mustapha Meftah and A. Sarkissian	The HRS high-resolution extraterrestrial solar reference spectra for disk-integrated, disk-center, or intermediate cases *(invited talk)*	P
Session 5. Local Processes of Magnetic-Flux Emergence. Sunspot and Starspot Formation *(ctd)* *Chair: Dmitry D. Sokoloff*			
15:00–15:15	Andrey G. Tlatov	Convective flows and the lifetime of sunspots	P
15:15–15:30	Ksenia A. Tlatova and A.G. Tlatov	The Wilson effect according to the analysis of averaged shapes of sunspots in 1919-2022	P
15:30–15:45	Zi-Fan Wang and R.H. Cameron	Flux emergence simulation and atmosphere response at ephemeral region scale	P
15:45–16:00	Mai Yamashita, Y. Itoh, Y. Takagi, and Y. Oasa	Chromospheric activities of pre-main-sequence stars	V
16:00–16:30	**Coffee Break**		
Chair: Bidya Binay Karak			
16:30–16:45	Nadezhda Zolotova, M.V. Vokhmyanin and R. Arlt	Solar activity reconstruction from the Georg Eimmart's archive of 1616–1720	P
16:45–17:00	Rebecca A. Robinson, M. Carlsson and G. Aulanier	Evolution of a nanoflare-scale magnetic reconnection event in the quiet Sun	P
17:00–17:15	Kiran Jain and S.C. Tripathy	Subsurface Flows in Active Regions with Peculiar Magnetic Configurations	V
17:15–17:30	M. Poisson, M. López Fuentes, C.H Mandrini, F. Grings and P. Démoulin	Modeling LOS magnetograms of emerging active regions	V

17:30–17:45	Varnana M. Kumar, T.E. Girish, Thara N. Sathyan, Haritha V.G. and G. Gopkumar	Super flares in M stars and associated characteristics of active regions and magnetic fields	V
19:00-22:00	**Conference Dinner**		
Friday, 25 August			
	Chair: Jie Jiang		
9:00–9:15	John T. Stefan and A.G. Kosovichev	Properties of Mean Phase Travel Time Deviations Preceding the Emergence of Large Active Regions during Solar Cycle 24	P
9:15–9:30	Hanlin Yang, C. Jin and J. Wang	Secondary flux emergence in ephemeral regions	P
9:30–9:45	Aidar M. Sadykov and S.A. Krasotkin	Magnetic field and radial velocity fluxes at the initial stages of the evolution of solar active regions based on measurements at the photospheric level	P
9:45–10:00	Andrei A. Plotnikov, A.S.Kutsenko and V. I. Abramenko	Decay of unipolar active regions	V
10:00–10:15	Anu B Sreedevi, B.K. Jha, B.B. Karak and D. Banerjee	An automatic algorithm to track bipolar magnetic regions in magnetograms to study the evolution of their properties	P
10:15–10:30	Ruihui Wang, J. Jiang and Y. Luo	A live homogeneous database of solar active regions based on SOHO/MDI and SDO/HMI synoptic magnetograms	P
10:30–11:00	**Coffee Break**		
	Session 6. Miscellaneous *(continued)* *Chair: Nathan Kleeorin*		
11:00–11:15	Ehsan Tavabi and R. Sadeghi	Characterizing Solar Spicules and their Role in Solar Wind Production using Machine Learning and the Hough Transform	P
11:15–11:30	G. G. Motorina, Yu.T. Tsap, J. Kašparová, V.V. Smirnova, A.S. Morgachev and M. Bárta	Modeling of the solar flare chromosphere and thermal sub-THz radiation	V
11:30–11:45	Yuriy T. Tsap, A.V. Stepanov and V.F. Melnikov	Sub-THz emission from stellar flares and energy release diagnostics	V
11:45–12:00	Viacheslav M. Sadykov, I.N. Kitiashvili, A.G. Kosovichev, A.A. Wray, I.K. Asante, and D. Erfani	Physical Properties of the Solar Atmosphere Derived from Comparison of Spectro-Polarimetric SDO/HMI Observables with 3D Radiative MHD Simulations	V

12:00–12:15	Alexander G.M. Pietrow	Center-to-limb variation of spectral lines and continua observed with SST/CRISP and SST/CHROMIS	V
12:15–12:30	Vardan Adibekyan and N.C. Santos	PoET: Mapping the Sun in space and time	P
12:30–14:30	**Lunch**		
Poster Session *Chair: Egor Illarionov*			
14:30–16:00	3-minute introductions to the subjects of poster contributions		
16:00–16:30	**Coffee Break**		
16:30–17:30	**Summary and Closing Ceremony**		
Posters			
1. Solar and Stellar Convection			
Prithwitosh Dey, Y. Bekki and L. Gizon	Probing the superadiabaticity of the solar convection zone with inertial modes		P
2. Differential Rotation and Meridional Circulation			
L. Kriskovics, Zs. Kővári, B. Seli , K. Oláh, K. Vida, G.W. Henry, T. Granzer and A. Görgei	Short and long term spot evolution on the subgiant component of EI Eri		P
Zs. Kővári, K. G. Strassmeier, L. Kriskovics, K. Oláh, T. Borkovits, B. Seli1 and K. Vida	Magnetic activity under tidal influences in the 2+2 hierarchical quadruple system V815 Herculis		P
Daria V. Litvishko, A. S. Kutsenko and V. I. Abramenko	Analysis of differential rotation of anti-Hale active regions		V
3. Global dynamo. Solar and Stellar Activity Cycles			
S. Koutchmy, Ehsan Tavabi	Chromosphere activity: relations with Solar cycles (SC)		P
Akash Biswas, P. Kumar, B.B. Karak and R. Cameron	Exploring the predictability of the solar cycle from the polar field rise rate: Results from observations and simulations		P
Anastasiya V. Zhukova	North-South asymmetry of the magnetic fluxes of active regions of different magneto-morphological types in cycles 23 and 24		V
Pawan Kumar, S. Wavhal and B.B. Karak	How supercritical is the solar dynamo?		P
Sergey V. Starchenko and S.V. Yakovleva	Correlation of shifted Wolf numbers with their derivatives, dynamo and predictions		P
5. Local Processes of Magnetic-Flux Emergence. Sunspot and Starspot Formation			

Vindya Vashishth and B.B. Karak	Hysteresis near the transition of the large-scale dynamo in presence of the small-scale dynamo	P
Ilan Roth	Flux Emergence Evolution as a Topological Entity	P
Sergey V. Starchenko	The simplest magnetohydrodynamic sunspot model	P
Yuriy A. Fursyak, V.I. Abramenko, A.A. Kutsenko and A.A. Plotnikov	Large-scale electric currents in processes in the solar atmosphere	V
6. Miscellaneous		
Anna M. Görgei, K. Vida, B. Seli and L. Kriskovics	Stellar activity in open clusters	P
Fabian Menezes, A. Valio,Y. Netto, A. Araújo, C. Kay and M. Opher	Trajectories of Coronal Mass Ejection from Solar-type Stars	P
Ehsan Tavabi and R. Sadeghi	Exploring Damping Properties of IRIS Bright Points using Deep Learning Techniques	P
Amaal A. Mohamed	Preliminary results on the flux rope existence of 15 Feb 2011 magnetic cloud event using nonlinear force free-field (NLFFF) model and the observational evidence of its CME deflection by a coronal hole	P
Victoria V. Smirnova, Yu.T. Tsap, G.G. Motorina, A.S. Morgachev and M. Bárta	Thermal instability in the impulsive phase of solar flares with sub-THz component	V
Olga A. Andreeva	Features of the solar minimum 24/25 in the evolution of polar and non-polar coronal holes	V
Sara Said Khodairy	Influence of Solar Activity on LEO Satellites	P
Maria E. Camisassa, R. Raddi, L.G. Althaus, J. Isern, A. Rebassa-Mansergas, S. Torres, A.H. Córsico and L. Korre	The dynamo magnetic fields in ultra-massive white dwarfs	P
Sergey V. Starchenko	Levels of stabilization of velocity and magnetic induction in the convective zone of the Sun	P
K. Vida, B. Seli1, T. Szklenár, L. Kriskovics and A. Görgei	Detecting coronal mass ejections with machine learning methods	P

Female: 20, male: 44

Summary of the scientific highlights of the meeting

Discussions of all aspects of solar/stellar convection-zone dynamics in both observational and theoretical aspects were productive and stimulating. The main ideas of the discussions are specified below for five main sessions of the symposium.

Session 1. Solar and stellar convection.

Thermal convection in the subphotospheric zones of the Sun and stars is responsible for the entire complex of active phenomena and, to all appearance, plays the role of the driver of the global dynamo. Convective phenomena received considerable attention at the symposium. It is remarkable that not only observational and theoretical (including numerical) results but also data of laboratory experiments were presented. Different mechanisms responsible for the excitation of convection were discussed. The spatial spectrum of convective structures and the effects of rotation on convection were particular points of consideration. The disagreement between some aspects of the theory and observational findings (the so-called convective conundrum) and possibilities of overcoming it were also subjects of debate. Attempts to simulate flows in stellar convection zones have been reported.

Session 2. Differential rotation and meridional circulation.

Differential rotation and global meridional flow are important for the dynamo process producing solar and stellar magnetic activity. Recent advances in understanding the dynamo-related global flows were reported at the meeting. The rapid increase in the rotation rate with depth shortly below the solar photosphere (in the so-called near-surface shear layer, NSSL) is considered to be important for the toroidal magnetic field winding from the near-surface radial field. The value and structure of the subsurface shear detected by helioseismology were reported at the symposium. Recent direct numerical simulations reproduce the seismological findings. They also supply the key characteristics of convection for theoretical understanding of the NSSL origin. Theoretical considerations on the NSSL explain the physics of this layer and quantitatively reproduce the seismologically measured shear with the convection parameters inferred from numerical experiments, thus signifying a breakthrough in understanding the near-surface differential rotation of the Sun.

Recent seismological measurements of the meridional flow by different research groups have converged to a coherent picture. The picture shows a global structure of one circulation cell per hemisphere. Dynamo models employing this flow structure reproduce closely the solar activity cycle.

Session 3. Global dynamo. Solar and stellar activity cycles.

Highlight of the recent years was that magnetic cycles similar to the solar cycle were found in simulations of large-scale convection. Although such simulated cycles differ from the observed ones, the very fact of their detection is a certain progress. As for mean-field models based on the physics of magnetic-field generation by differential rotation and small-scale helical motions, they reproduce the observed solar-activity cycle very closely. Applications of the dynamo models to the sun-like stars are less successful. The observed shortening of stellar activity cycles with rotation rate remains unexplained.

Dynamo theory suggests the polar magnetic field at the activity minima to be a precursor of the strength of the following activity cycle. Reliability of the predictions based on the polar field has been confirmed observationally, and forecasts made four to five years in advance of the coming activity maximum are satisfactory. Efforts are currently focused on extending the reliable prediction to earlier dating.

Session 4. Helioseismology and asteroseismology.

Observational detection of large-scale Rossby waves is a recent highlight with helioseismology. Observed characteristics of the inertial oscillations and their theoretical modeling were reported at the symposium. It was concluded that inertial modes can be excited by thermal convection. An important inference was that the inertial modes can in turn be used as a probe for deep solar convection. Observed variations of the inertial modes in course of the solar activity cycle were presented in line with a discussion of their possible origin.

New results on using the mixed gravito–acoustic oscillation modes for sounding the rapid rotation of kernels of read giant and subgiant stars were reported and viably discussed by the symposium.

Session 5. Local processes of magnetic-flux emergence. Sunspot and starspot formation.

Multifaceted views of the formation and evolution of active regions and sunspots (starspots) were presented at the symposium. Although some arguments in favour of the paradigmatic idea of magnetic-flux emergence via the buoyant rise of an omega-shaped tube of strong magnetic field were presented at the meeting, this model was not assumed to offer a unique, unquestionable possibility: observational features contradicting this model were found. Accordingly, various local-dynamo mechanisms of sunspot formation were discussed. In particular, the role of convective motions in the formation of locally enhanced magnetic fields was discussed. Some attention was given to the topical problem of interaction between local and global magnetic fields.

Subsurface flows in emerging solar active regions were investigated. Helioseismic precursors of the development of active regions were discussed. Certain steps were taken to develop techniques for helioseismological sounding of subphotospheric magnetic fields in sunspots.

Executive Summary

Heliophysics is the field of astronomy closest to our terrestrial life. The symposium has demonstrated that the dynamics of the dense layers of the Sun and stars is especially important for the comprehension of the entire complex of active phenomena because precisely in these layers magnetic fields and therefore all active phenomena originate. In essence, the solar convection zone is the 'kitchen' of solar activity, where the magnetic fields responsible for the whole sequence of active phenomena are 'cooked'. This should also be the case in many other stars. Thus, the symposium was at the cutting edge of science and was indicative for the rapid and impressive progress in this field.

Convective phenomena in the Sun and stars received considerable attention at our meeting, and the importance of the comprehensive investigation of convective phenomena was demonstrated. According to current understanding, solar and stellar convection plays a fundamental role in the mechanism of differential rotation and meridional circulation (which, in their turn, are of crucial importance for the action of the global dynamo); on the other hand, convective motions should be an essential ingredient of local dynamos.

The session of the symposium dedicated to differential rotation and meridional circulation has demonstrated substantial progress achieved in the research of these global velocity fields. In particular, much attention has been given to such a fine detail of the phenomenon as the near-surface shear layer, which is currently investigated both observationally (using helioseismological techniques) and theoretically. The area of research has been extended to stellar convection zones. The theoretical understanding of the global flows becomes progressively more complete.

The global dynamo, both solar and stellar, is a phenomenon intrinsically related to the global flows. The stream of research papers on the global dynamo is growing dramatically and embraces now diverse dynamo mechanisms under various conditions. Stars of different spectral classes are currently studied from the point of view of the action of global dynamo mechanisms.

The development of helioseismology and asteroseismology resulted in the formation of a consistent picture of various phenomena occurring in the depth of the Sun and stars, the phenomena that could not be studied by direct observations. On this way, properties of the velocity fields—convection on different scales, differential rotation and meridional circulation etc.—in the layers not observable directly have been deciphered.

Local processes of magnetic-flux emergence and sunspot/starspot formation are now actively studied, as our symposium has demonstrated. Various approaches are being used and various mechanisms are being investigated. The research in this area is approaching the resolution of the crucial issue of the theory of solar and stellar activity—the genetic relation and interaction of global and local dynamos.

The symposium proved to be interesting, fruitful and encouraging for future efforts. It would be worthwhile for the IAU to support this topical area of astrophysics more frequently arranging meetings on similar subjects in the future.