COMMISSION B1	**COMOPUTATIONAL ASTROPHYSICS**
	ASTROPHYSIQUE NUMERIQUE

PRESIDENT	**Christian Boily**
VICE-PRESIDENT	**Michiko Fujii**
PAST PRESIDENT	**Dmitry Bisikalo**
ORGANIZING COMMITTEE	**Edouard Audit, Pratika Dayal, Tomoyuki Hanawa, Jonathan MacKey, Shazrene S. Mohamed, Dmitri S. Wiebe, Gustavo Yepes**

COMMISSION B1 WORKING GROUPS

TRIENNIAL REPORT 2021-2024

1. Background

The groundwork for this commission started in 2016 at the initiative of S. Portegies Zwart, who floated the idea that computational astrophysics had become such a wide-ranging field of research that it deserved its own platform for exchanges, scientific meeting and hands-on experiences within Division B (Facilities, Technologies, Data Science). His call for action did not go unnoticed, and the response by the community of computer *appassionati* and astronomers made it possible to kick-start this project. The broad objectives of the commissions are†

> ...*to combine efforts of scientists solving computationally demanding problems (gas dynamics, MHD, radiation transfer, N-body, data processing, etc.) in order to share approaches, ideas and methods; to assess the current level, requirements, bottle-necks and future prospects of numerical simulations; to ensure the needed level of synergy between various models; to probe the potential of citizen science and distributed computations; to organize conferences, workshops, computational astrophysics schools,* ...

and more. In fact, these goals are so far-reaching that they are split within Div. B between *three* commissions, namely this one, Commissions B2 (Data and Documentation), and B3 (Astroinformatics & statistics). Each of these commissions have their own specific targets, for sure, yet they all have in common an appreciation of, and reliance on, the technology for storage and analysis that computers provide. If we (CB1) focus more on algorithmic procedures and differential equations, it should be clear that the analysis and management of large volumes of (model) data and their interpretation have benefitted much from the advent of machine learning and artificial neural networks (AI), an approach shared by (essentially) all Div. B commissions. Thus the challenges and prospects

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† Quote lifted from the CB1 homepage

for advances remain enormous, and this report only covers a patch of this rapidly expanding domain. I offer some personal views, a wish-list if you like, for the forthcoming triennial, in the closing section.

2. Review of activities for the last exercise

The Commission B1 activities over the last three years reached a cruising mode where the membership has peaked at 364 members (at the time of writing) and regular exchanges with members have been made more regularly by the publication of a trimestrial newsletter. The last three years saw several major events take place, of which I would like to underscore three:

2.1. *IAU S362 (November 2021)*

This long-delayed Symposium (thank you Covid-19) finally took place in virtual mode and, given the circumstances, proved rather successful. We all regretted not making the trip to Chamonix, but nevertheless with on-line facilities becoming a new reality we can now look back and consider S362 as ground-braking, with the possibility of external participants joining in at very low costs (financially, as well as to the environment) .

2.2. *The ChaiCA-IV meeting (November 2022)*

Some 120 participants took part in this on-line only meeting, mostly drawn from our membership but not exclusively. The appeal of computational astrophysics to a broader community (think engineering, AI paradigm and applied mathematics) encourages us to take a more pro-active stance to advertise such meetings throughout the community of astrophysical research, and beyond.

2.3. *The ChaiCA-V meeting (November 2023)*

In this latest instalment we again attracted over 120 participants and, importantly, noted that the programme of talks (keynote, contributed) proved radically different from the previous two meetings in the series. We hope that this is indicative of a certain dynamic and renewal within this community.

3. Prospects for the new triennial

Aside from these events, we are completing a full circle since the last IAU GA in Busan, South Korea in 2021, during which Commission B1 business was summed up in a special session on Division B activities. Indeed at the next GA in Cape Town, South Africa, the programme includes a special Focus Meeting setup by S. Mohamed (U. Virginia, US) during which topics on computational astrophysics will mingle with up-coming astrophysical facilities (SKA comes to mind, but LSST and many more, too) for what we hope will be a new springboard for this commission heading to a new term. The CB1 FM in Cape Town will include hands-on practicals (you just have to like the moniker "hack-a-thons" used for those!) which we hope will start a new trend for future meetings.

Today we are contemplating a turning point for commission B1 with all but three of the committee members retiring / stepping down. Michiko Fujii (Tokyo) will take over as president and I am sure she will be in a good position to develop further the interests of computational astrophysics in the broad astronomical community.

I would end this report by re-asserting that we are much aware that astrophysics

progress hand-in-hand with technological advances, whether from instrumentation or computational sciences. There is still a crying need to have more hands-on demonstrations and exchanges to cross-match ideas and identify areas where progress can be achieved: it should be possible to setup working groups (WGs) to keep in sync with activities at comissions B2 & B3, for instance ; and to aim for more in-person *workshops*, perhaps in hybrid mode, when participants (PhD candidates and PDRAs especially) can keep abreast of recent developments. Such for of activities will only become more essential as the pace of technological advances is set to accelerate ever more.

Christian Boily
President of the Commission

References

Bisikalo, D., Wiebe, D. & Boily, C. M. (eds.) 2023, *The Predictive Power of Computational Astrophysics as a Discovery Tool*, Proceedings of IAU Symposium 362 (Cambridge: The University Press)

The Commission B1 Newsletters are available <u>on line</u> at the website hosted by Chiba University in Japan (courtesy T. Hanawa, with further input from D. Wiebe).