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Subject: Nomination of Dr. Barbara Perri to the Alexander Chizhevsky Medal

Saclay, 10 July 2025

Dear Colleagues,

It is with great pleasure that we write to ESWW Awards panel to nominate Barbara Perri for the 2025 Alexander Chizhevsky Medal.

We've known Barbara for 10 years now, ever since she took the Magnetohydrodynamics of Solar Plasmas final year course in the Master 2 Simulations program that one of us teach, for which she obtained the highest mark in her class, before becoming an M2 trainee and then a PhD student in our DAp-AIM research group at CEA Paris-Saclay. Let us give you a few more details. Barbara studied physics and mathematics at an excellent level in France and obtained an engineering degree from ENSTA-ParisTech. She simultaneously did a master's degree in applied mathematics and physics, and gave an excellent M2 defense on dynamo in stellar radiative zones. She then joined the prestigious Paris astrophysics doctoral school to study the coupling between internal magnetism, solar wind and coronal physics in the context of the fast-developing subject of Space Weather. To achieve this, she had to combine multidimensional high-performance computing (HPC) simulations of ground and space data with a deep theoretical understanding of solar internal and external dynamics. She was awarded the highly selective funding for a research training contract (CFR) from the CEA in the "Best student" category.

During her thesis years, Barbara developed an acute intuition for the internal turbulent dynamo at the origin of the 11-year cycle, and for solar wind and coronal physics. She also acquired with incredible ease a very strong technical competence in HPC simulations, parallel programming and advanced analysis of large multi-dimensional, time-dependent and multi-physics/variables datasets (scientific big-data approach). Her work has led to several major theoretical works of the highest international standard, based on her numerical simulations with the PLUTO 3-D parallel code. She has already published 28 A-rank papers, including 9 as first author, despite her young age and the Covid19 pandemic. The international community has recognized the high quality of her work by giving her several invited talks at international conferences (ESWW, EGU). She also has been the speaker representing the Sun-Earth Relations thematic action at the plenary session of the French Astrophysics Week 2025 meetings.

We'd like to emphasize the world-leading step forward she made during her thesis on dynamo and wind dynamics coupling. This coupling is based on a completely innovative four-layer boundary condition, enabling causality to be respected in the heliosphere for any internal change in the dynamo and coherent transfer of magnetic flux and helicity. She had to get to the heart of the parallel PLUTO code to validate her results with dynamo and wind. She demonstrated that the dynamo influences the wind, which was of course expected, but more importantly, that the wind influences the dynamo by changing the boundary condition imposed by a wind. This is a very important result in solar plasma physics, with implications for our understanding of other stars. Barbara also acquired expertise in 3D dynamo with the ASH code, and helped develop the Wind-Predict 3D wind model with the PLUTO code.

Barbara is therefore one of the very few young researchers in the world currently mastering the many aspects of solar wind and dynamo in 3-D, and the importance of this coupling for space weather. Barbara can reproduce virtual satellites trajectory or describe heliospheric conditions around planets in the solar system for any date, using realistic maps (magnetograms) derived from observations of the Sun. This is essential with the space missions (Solar Orbiter, Parker Solar Probe and soon Vigil) to study the Sun and Sun-Earth relations, which require high-performance tools to analyze and understand the extended environment around the Sun and Earth. Barbara also worked with Prof. Axel Brandenburg (Sweden) on

sunspot formation, publishing a paper with him. Given the high opinion he has of her, Prof. Brandenburg has agreed to co-sign the nomination letter with us. On top of her PhD work, Barbara was also at the same time a teaching assistant at the University of Paris 7, demonstrating her solid academic skills and pedagogy. The strength of her work and her unfailing commitment to sharing her knowledge and passion make her a researcher of international stature.

Between November 1, 2019 and October 2020, Barbara was a postdoc at IAS, Orsay to get closer to solar data particularly following the launch of Solar Orbiter in February 2020. She set up a database at Medoc data center on her work on cosmic rays in the inner heliosphere (following one of her first-author papers) and helped manage the data present at Medoc, which she continues today for her duty task as assistant astronomer. Then, in autumn 2020, she joined Prof. Stefaan Poedts' team in Leuven to participate in the pan-European space weather consortium developing the ESA-funded Virtual Space Weather Modelling Centre (VSWMC). The 3D wind model MHD Wind Predict that she co-developed was integrated by ESA under her leadership (writing of technical documents, code transfer and compilation, automation) to be part of the tools available for forecasting the state of the space environment around our planet. Barbara has therefore made a very important contribution to the development of an integrated European model from Sun to Earth, such as the VSWMC.

Since September 2022, Barbara has been an assistant astronomer at AIM as part of Observatory of Paris-Saclay. Here, she is pursuing her leading research in collaboration with the AIM and IAS teams, and also with the KU Leuven team. In particular, she has extended her field of study to include coronal mass ejections (Perri, Schmieder et al. 2023) and continues to push the realism of heliospheric models for space weather (Perri et al. 2024). She also co-created in 2023 a brand-new advanced course on Space Weather for space engineers being taught at the space engineering school ESTACA, France as well as a series of 8 posters on Space weather for public outreach (first shown at ESWW in Toulouse).

In 2024, she was awarded a national 400,000€ grant on the Space Weather, *WindTrust*, with the aim of improving the robustness of coronal and heliospheric model predictions. She is co-directing the writing of a Space Weather bulletin emanating from our team. In 2023, she also joined the *Organisation Française pour la Recherche Applicative en Météorologie de l'Espace* (OFRAME), helping greatly to organize the European Space Weather Week in Toulouse as a LOC member. Moreover, she has played an active role in the organization of many sessions at ESWWs: she was the co-convener of the SWR1 session (solar 2022, sources of solar wind) and in 2025 of CD5 (validation) and SWR5 (space climate). She also got an invited talk at EGU in 2022 and several at ESWWs. Finally, she is a co-team leader of ISWAT initiatives such as H1-03 (scoreboard definition for solar wind forecasting), H1-01 (real time validation of solar wind) and a member S2-06 (Origins of the Spectral Irradiance and its Intermediate Timescale Variability).

In 2025, she joined the scientific council of the Sun-Earth national (french) program, and is taking on increasing responsibility for the solar database at MEDOC through her involvement in Solar Orbiter. She is therefore very involved in the scientific organization of Space Weather in France, Europe (ESWW, EGU) and world-wide (ISWAT), as well as being an excellent scientist and serving as a role model for young women in science, a theme particularly close to her heart. She is currently co-supervising a doctoral thesis and a post-doctoral student for her ANR WindTrust - helping to train the next generation of astrophysicists.

In conclusion, and as you will have gathered from reading this letter, Barbara has done remarkable thesis work, innovative post-doctoral studies, and has an incredible start in her tenured career in academia in pre-operational scientific support for Space Weather and in solar, plasma and heliospheric physics. She has already demonstrated her ability to carry out research that is relevant and useful to both the scientific community and civil society. Barbara is truly a unique person, always ready to listen to others, to help and to pass on her passion (through educational videos, engineering school or to the general public). She would undoubtedly make an ideal winner for this year's ESWW Alexander Chizhevsky Medal.

Yours Sincerely,

Dr. A. Sacha Brun  Dr. Antoine Strugarek  and Prof. Axel Brandenburg