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PREFACE

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Abstract. Astro Fluid – An international conference in memory of Professor Jean-Paul Zahn's great scientific achievements.

Jean-Paul Zahn is recognized worldwide as one of the fathers and pillars of modern theoretical astrophysics. His early and foundational work on equilibrium and dynamical tides in close binaries has strongly impacted the field. He was the first to predict the characteristic time scales of the dissipative processes that lead to rotational synchronisation and orbital circularisation. After his so-called Thèse d'Etat, he brought his keen mind to bear on broader topics in stellar fluid dynamics. In collaboration with his friends and colleagues Ed Spiegel (Columbia University, New York) and Juri Toomre (Colorado University, Boulder), one of the fruits of his focused work in stellar convection theory was the co-discovery of the solar tachocline. At this thin interface between the convective and the radiative regions, the Sun's internal rotation profile dramatically changes. This shear layer is now also recognized to play a major role in the generation of magnetic field in solar-type stars. During the same year, Jean-Paul published a seminal paper on the nature of differential rotation in stellar radiative interiors, deriving descriptions of its physical mechanisms that could be introduced into simulations of stellar evolution. This insight has led to a true revolution in the field of stellar physics. Furthermore, it holds tremendous implications for galactic astrophysics given that rotation impacts most stellar properties and those of stellar populations in general. Beyond these emblematic highlights, Jean-Paul contributed to many important problems in astrophysical fluid dynamics, such as penetrative convection, thermohaline diffusion, magnetic dynamo theory, internal gravity waves, turbulence in accretion disks. He also participated in laboratory experiments akin to Taylor-Couette flow that resemble differential rotation in astrophysical fluids. Jean-Paul Zahn was the advisor of ten PhD students and a collaborator with many other young researchers who are now active leaders in theoretical astrophysics. As such, he is considered as the founding member of an internationally renowned

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school of astrophysical fluid dynamics that is tackling some of the major problems of stellar astrophysics that bridge astronomical observations, fundamental theory, and laboratory experiments.

Jean-Paul Zahn received several prizes and awards for his scientific achievements: médaille de bronze of the CNRS 1967, Prix Henri Rey of the Académie des Sciences 1969, Prix Paul et Marie Stroobant of the Académie Royale de Belgique 1983, Prix Jules Janssen of the Société Astronomique de France 2003, and the Prix du CEA, Grand Prix of the Académie des Sciences 1997. His services to the scientific community have also been numerous and priceless. He was the director of Nice Observatory and of the Pic du Midi Observatory, the President of the French Society of Astronomy and Astrophysics and of the European Astronomical Society. Since the 1970s, he has held numerous positions of responsibility in scientific organizations of various kinds. He directed the Observatories of Nice (1972–1981), Pic-du-Midi and Toulouse (1981–1988). He has chaired bodies such as the National Committee for Scientific Research, the Scientific Council of the INAG (1975–1980), the French National Committee for Astronomy (1982–1984), the founding association of CERFACS (1984–1987), the association for the Fondation du Pic-du-Midi (1986–1993), the Scientific Council of the Vector Computing Centre for Research (1983–1987), the French Society of Astronomy Specialists (1992–1994), the DEA Astrophysics and Space Techniques (1995–1999), the Star Constitution Commission of the IAU (1997–2000), the European Astronomy Society (EAS) (1997–2001). He was also scientific editor of EAS Publications Series (at EDP Sciences) (2000–2014), and the President or member of various evaluation boards such as the University Evaluation Committee, the Centre d'études et de recherches en géodynamique et en astrométrie, the Institut d'Astrophysique de Paris, the Institut d'Astrophysique Spatiale, the Observatories of Besançon, Grenoble, Haute Provence, Lyon, Marseille, Paris, and Strasbourg, the Service d'Astrophysique Saclay (DAPNIA/CEA Saclay). He was the organiser of the Aussois School of Stellar Physics (1997–2012), the Houches School of Physics (1987), a NATO school in Bucharest for the 1999 eclipse, and of various international congresses (Nice 1976; Toulouse 1984; Les Houches 1989; Joint European and National Astronomical Meetings 1998, 1999, 2000, 2001; Joint Discussion 5 of the UAI 2000).

This volume gathers reviews and contributions on the major research subjects of Jean-Paul Zahn: Tides in Stars and Planets (Chapter I), Seismology and Stellar Structure, Evolution and Rotation (Chapter II), Convection and Magnetism (Chapter III), Instabilities, Turbulence, and Disks (Chapter IV). We dedicate this book to the memory of our dear friend and mentor in whose steps we continue to proudly walk.

We warmly thank the Scientific Organizing Committee. We are also greatly indebted to our colleagues from IAP and Paris Observatory for their hard work on the practical organization of the conference.

The editors – Sacha Brun, Stéphane Mathis, Corinne Charbonnel, Bérengère Dubrulle.