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Special issue in memory of Jean-Pierre Demailly

Jean-Pierre Demailly passed away prematurely on 17 March 2022, shortly before his 65th birthday. He was an outstanding mathematician, who embodied integrity, enthusiasm, and professionalism, coupled with a deep humanity. This special issue of Pure and Applied Mathematics Quarterly pays tribute to his profound contributions to complex analysis and geometry, and his particularly innovative ability to develop powerful analytic tools and apply them to deep problems in algebraic geometry.

Jean-Pierre was born in 1957 in Péronne, a small town in the north of France, and was admitted at the Ecole Normale Supérieure in 1975. Under the guidance of Henri Skoda and in contact with Pierre Lelong, his first work addressed a question posed by Jean-Pierre Serre regarding Stein fiber spaces, earning him early recognition. He then turned to the study of closed positive currents, their Lelong numbers, regularization, and the use of Monge-Ampère operators. He established his famous holomorphic Morse inequalities, developed and employed Hörmander's L^2 techniques, Dolbeault cohomology, and particularly refined curvature calculations to obtain vanishing theorems for line and vector bundles over algebraic varieties. His use of analytic methods later allowed for major advancements towards Fujita's conjecture in the

1990s, and three decades later, his results have seen very few improvements. He dramatically expanded the study of Kähler varieties and their subvarieties with several collaborators using powerful and fundamentally original analytic methods (introduction of singular metrics, non-vanishing theorems, characterization of the Kähler cone, numerically effective and pseudo-effective cones, study of manifolds for which the tangent bundle or the anticanonical bundle is positive, etc.). He further launched a broad program to study complex hyperbolic varieties in the direction of the Kobayashi and Green-Griffiths-Lang conjectures (studying entire curves, differential jet spaces, and their sections), where his technical prowess and virtuosity shone.

His research has inspired mathematicians from all continents, and he has collaborated with the most prestigious experts in complex analysis, analytic geometry, and algebraic geometry. His broad vision has built previously unsuspected bridges between major mathematical domains.

Jean-Pierre Demailly has also devoted himself to the transmission of knowledge to his many doctoral and postdoctoral students, as well as to young researchers more generally. He has contributed to the growth of mathematics in Tunisia, India, and China through regular visits. The list of his interventions abroad at conferences or thematic schools is countless. Deeply concerned about the quality of education provided to current generations, he has engaged in improving the French educational system as president of the GRIP (Interdisciplinary Reflection Group on Programs), a non-profit association responsible for a national educational experiment called "Savoir Lire Écrire Compter Calculer" (Knowing How to Read, Write, Count, Calculate).

He was also among the pioneers advocating for the free circulation of knowledge. His book "Complex Analytic and Differential Geometry," now an essential reference, has continuously evolved over the years and has always been freely available on his website. He is one of the founders of Episciences, a platform that provides scientific validation from an editorial committee for articles disseminated in open archives. Very involved in the free software movement, Jean-Pierre Demailly has contributed to its dissemination both locally and nationally.

His personality and passion for mathematics have left a mark on generations of students and sparked many careers dedicated to science. His written works, courses, research talks and public lectures have always stood out for their clarity. Generous and approachable, he has trained about twenty doctoral students, most of whom are now recognized mathematicians. He received a large number of distinguished international prizes, among which the Heinz Hopf Prize in 2021 and the Stefan Bergman Prize in 2015, he was an invited plenary speaker at the International Congress of Mathematicians in 2006 and

a sectional speaker in 1994, and was a member of the French Academy of Sciences and a senior member of the Institut Universitaire de France.

Jean-Pierre is highly regarded by his colleagues, students, and doctoral students. He was not only an excellent mathematician but also an exceptional individual and an outstanding colleague. This special issue includes contributions from a number of his friends and colleagues, and is a testimony to Jean-Pierre's exceptionally broad and deep mathematical work.

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