Short citation:

Barry Mazur is awarded the 2022 Chern Medal for his profound discoveries in topology, arithmetic geometry and number theory, and his leadership and generosity in forming the next generation of Mathematicians.

Long citation:

Barry Mazur has shaped the modern landscape in arithmetic, by way of tackling the most difficult problems in the area, pioneering exciting new directions, and guiding generations of mathematicians to fertile new terrain. His numerous fundamental contributions place him squarely within the ranks of the greatest mathematicians of the 20th century.

His proof of the torsion conjecture for elliptic curves gives an explicit list of possibilities for torsion subgroups of elliptic curves over the rational numbers. Aside from being a result of supreme elegance and finality, it is remarkable for the method of proof, which applies sophisticated methods of arithmetic geometry, notably the theory of group schemes in the flat topology and the geometry of arithmetic moduli spaces, to the study of a concrete diophantine question.

The deep study of the ring theoretic properties of completed Hecke algebras which this work initiated, along with the deformation theory of Galois representations which Mazur pioneered several decades later, laid the groundwork for Andrew Wiles' proof of the modularity of elliptic curves and Fermat’s last theorem. Indeed, it has enabled an avalanche of results in the Langlands programme and its applications, as well as advances in the study of special values of L-functions following the conjecture of Bloch and Kato.

Mazur's proof of the Iwasawa Main conjecture with Andrew Wiles in the early 1980s is another monumental achievement, which realises the zeroes of the Kubota-Leopoldt p-adic zeta function as the eigenvalues of a natural operator acting on the ideal class groups of cyclotomic towers, and can thus be viewed as the analogue of the Riemann hypothesis for the p-adic zeta functions attached to Dirichlet characters.

The extension of the methods of Iwasawa theory to the setting of elliptic curves and more general motives was largely spearheaded by Mazur, through his construction with Peter Swinnerton-Dyer of the p-adic L-function of a modular elliptic curve, his formulation of the p-adic Birch and Swinnerton-Dyer conjecture with John Tate and Jeremy Teitelbaum, and his seminal program for the study of abelian varieties over towers of number fields.

These great achievements themselves are but a sampling of highlights within a broad, deep, and sustained range of influential perspectives that have enriched mathematics over the last fifty years, touching on such topics as the generalised Schoenflies problem, p-adic cohomology theories, the Fontaine–Mazur conjecture characterising the p-adic Galois representations that arise in geometry, the theory of "Euler systems", and the study of rational points on curves and higher dimensional varieties, to name just a few.

Mazur's influence is cemented by his role as a mentor and a teacher, with close to 60 PhD students of whom a great many have actively and fruitfully pursued his capacious intellectual legacy.

Barry Mazur's view of the subject is a supremely pluralistic one, in which pure curiosity interacts constantly with visionary theory-building, and the pursuit of deep structures for their own sake is just as important as computational experiments and the resolution of difficult problems. The impact he has had on mathematics dramatically illustrates the revolutionary potential of such a versatile perspective.