The 2019 Gribov Medal for outstanding work by a young physicist in Theoretical Particle Physics and/or Field Theory is awarded to Douglas Stanford for his pioneering work on quantum chaos and its relation to the near-horizon dynamics of black holes.

The apparent paradoxes associated with the physics of black holes have been driving research in quantum gravity for several decades. The discovery of holographic dualities in the 1990s led to a description of the near-horizon physics of black holes in terms of ordinary quantum mechanical systems. Despite this striking change of paradigm, some of the most important questions remain open: How is quantum information processed during the formation and subsequent evaporation of a black hole? What is the experience of an observer falling through the black hole horizon? There is hope that the answers to such questions will ultimately lead to a consistent theory of quantum gravity with possible applications to the physics of the very early Universe.

The work of Douglas Stanford has opened new perspectives both on the physics of black holes and on the physics of chaotic quantum systems and was extremely influential in both communities. While still a student he wrote two important papers with Stephen Shenker identifying the large quantum effects near black holes (whose existence was earlier conjectured by Gerard 't Hooft, Leonard Susskind and others) with the growth of out-of-time-order correlation (OTOC) functions in the dual quantum mechanical system. In a later paper with Juan Maldacena and Stephen Shenker, he derived a general bound on quantum chaos for a large class of systems and showed that it is saturated by the growth of perturbations near a black hole. In more recent work he has identified general features of simplified quantum mechanical models relating to gravity and developed a remarkable relationship with random matrix theory.

Douglas Stanford is a long-term member of the Institute of Advanced Study in Princeton.