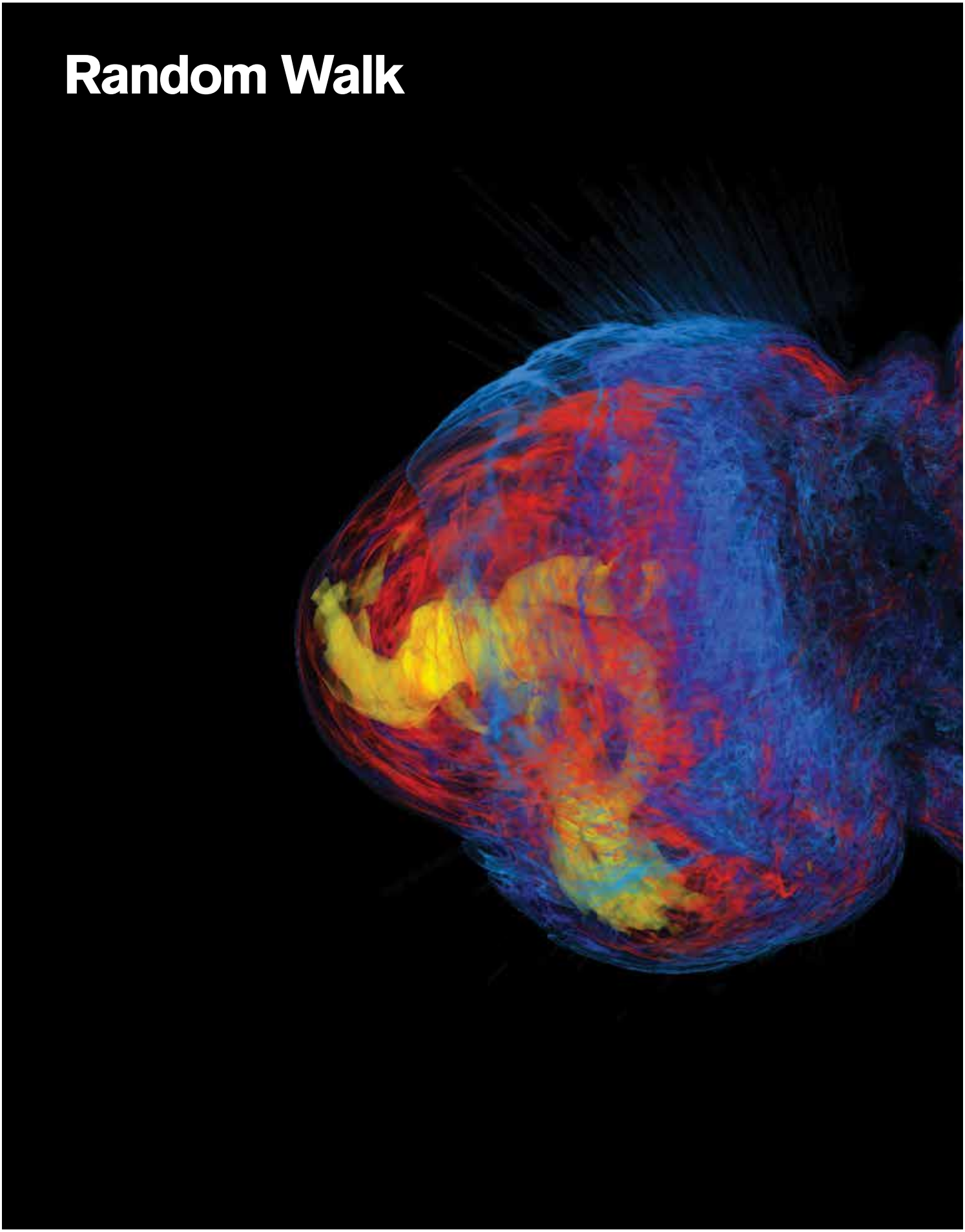
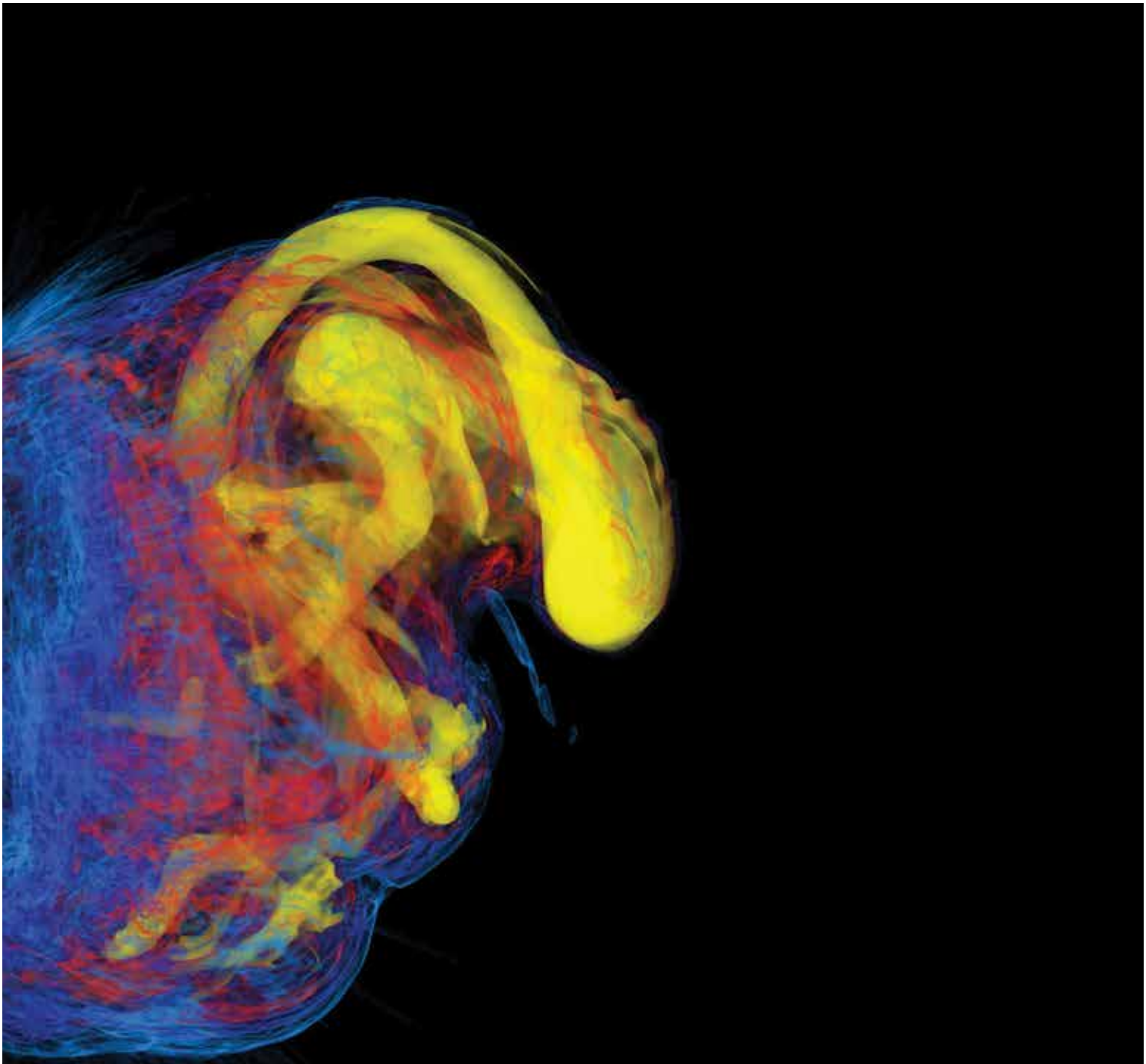
Random Walk





CORE INSTABILITY

When massive stars collapse, as they inevitably do, they often then explode into a supernova—but not always. For astrophysicists, it has been a challenge to figure out what drives the explosion after the initial collapse of the core of a massive star. Recently, Caltech postdoctoral scholar Philipp Mösta and professor of theoretical astrophysics Christian Ott simulated the collapse of a three-dimensional rapidly rotating star with a strong magnetic field. They introduced a tiny asymmetric perturbation around the core's axis of symmetry to see if it had an effect on the star's explosion. In the simulation illustrated here, the perturbation triggers a "kink instability" that results in two lobes of twisted and highly magnetized material that do not show signs of a runaway explosion—a supernova—at the end of the simulation. "As the material expands, it gets wound in tubes around the spin axis of the star, like water being expelled vigorously from a twisting garden hose left lying on the ground," says Mösta. More and longer simulations on more powerful supercomputers will be needed to determine the final fate of core collapse in such a rapidly rotating magnetized star.