## Linking number cascade in non-Abelian quantum turbulence Michikazu Kobayashi, Kyoto University Universality class of fully developed turbulence Turbulence : A big unresolved energy injection inertial range energy dissipation conservation law universality class puzzle in classical mechanics cascade in the inertial range • energy cascade $\varepsilon_E$ nergy spect $\rightarrow \nu = 2/3$ $\eta = 5/3$ $E = rac{1}{2} \int doldsymbol{x} \, oldsymbol{v}^2$ : energy (2D, 3D) (Kolmogorov's law) $E(k) \propto \varepsilon^{\nu} k^{-\eta}$ $\Omega = rac{1}{2} \int dm{x} \ ( abla imes m{v})^2$ : enstrophy (2D) • enstrophy cascade $\varepsilon_{\Omega}$ $\rightarrow \nu = 2/3$ $\eta = 3$ $H = \int d\boldsymbol{x} \, \boldsymbol{v} \cdot (\nabla \times \boldsymbol{v}) : \text{ helicity (3D)}$ (2D turbulence) 1/LUniversality class with the helicity cascade has not been observed!

Quantum turbulence : new turbulent system with quantized vortices

quantized vortex



Helicity in quantum fluid



Conclusion : We first obtain a new universality class  $\nu = 2/3$   $\eta = 7/3$  in non-Abelian quantum turbulence with topologically protected linking number cascade