Some applications of fractional diffusion and related theoretical and computational open problems

- Turbulent transport in magnetically confined fusion plasmas
  [e.g., *Nuclear Fusion* **48**, 75009 (2008); Phys. *Phys. Rev. Lett.* **94**, 065003 (2005)]
- Chaotic transport in geophysical fluid dynamics
  [e.g. Nonlin. Process. Geophys. **17** 795 (2010)]
- Reaction-diffusion systems: Fractional Fisher-Kolmogorov equation for superfast front propagation
  [e.g., *Phys. Rev. E,* **79**, 031120 (2009); *Phys. Rev. Lett*., 91, (1), 018302, (2003)]
- Fluctuations-driven transport: Levy ratchets [Physica *A*, **27** 6693-6704 (2008)]
- Finance: Fractional-Black-Scholes equation for derivative pricing in the presence of Levy flights [e.g *Physica A* 374 (2) 749-763 (2007)]
- These and other applications require the extension of the standard fractional diffusion models to incorporate: tempered Levy processes [e.g. *Phys. Rev. E.* **76**, 041105 (2007)] and finite size domains [e.g. *Phys. of Plasmas* **13**, 082308 (2006)].
- These are theoretical and computational challenging problems!

D. del-Castillo-Negrete