Origin of Dynamics in Glassy Materials

Opportunity

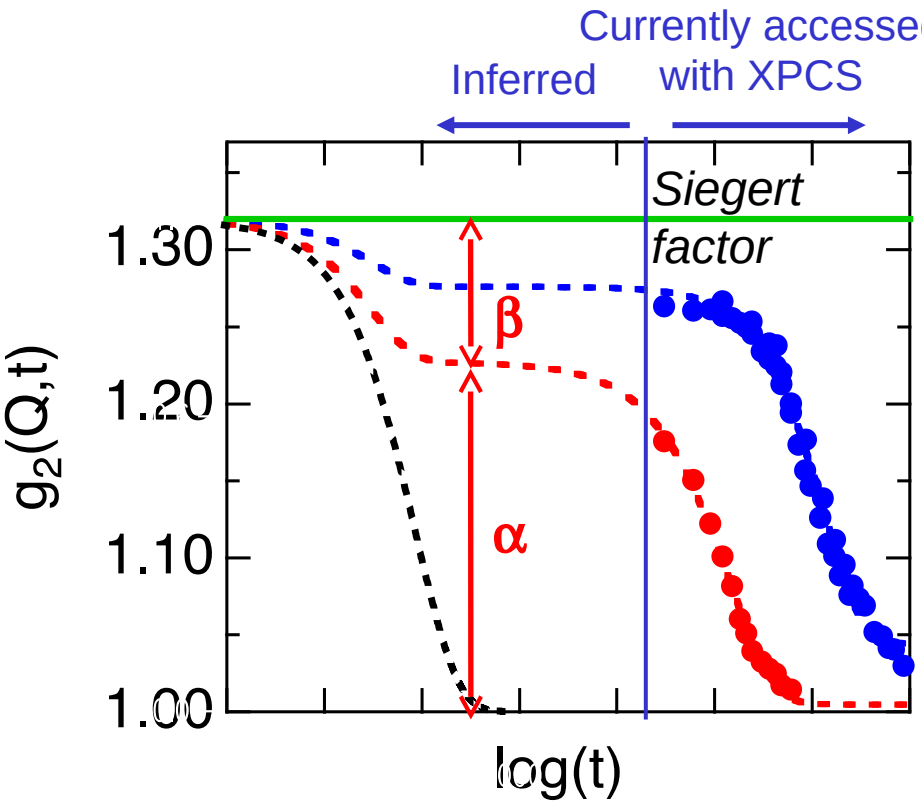
- Hierarchical dynamic phenomena in glassy materials: colloidal suspensions, gels, nanoemulsions, polymers. Microscopic origin of high viscosity in glassy materials.
- Ability to probe both the alpha and the beta relaxation at the nanoscale

Challenge

- Limited coherent flux to access micro second time scales
- Limited coherent fraction to access nanometer length scales

4GSR Strength

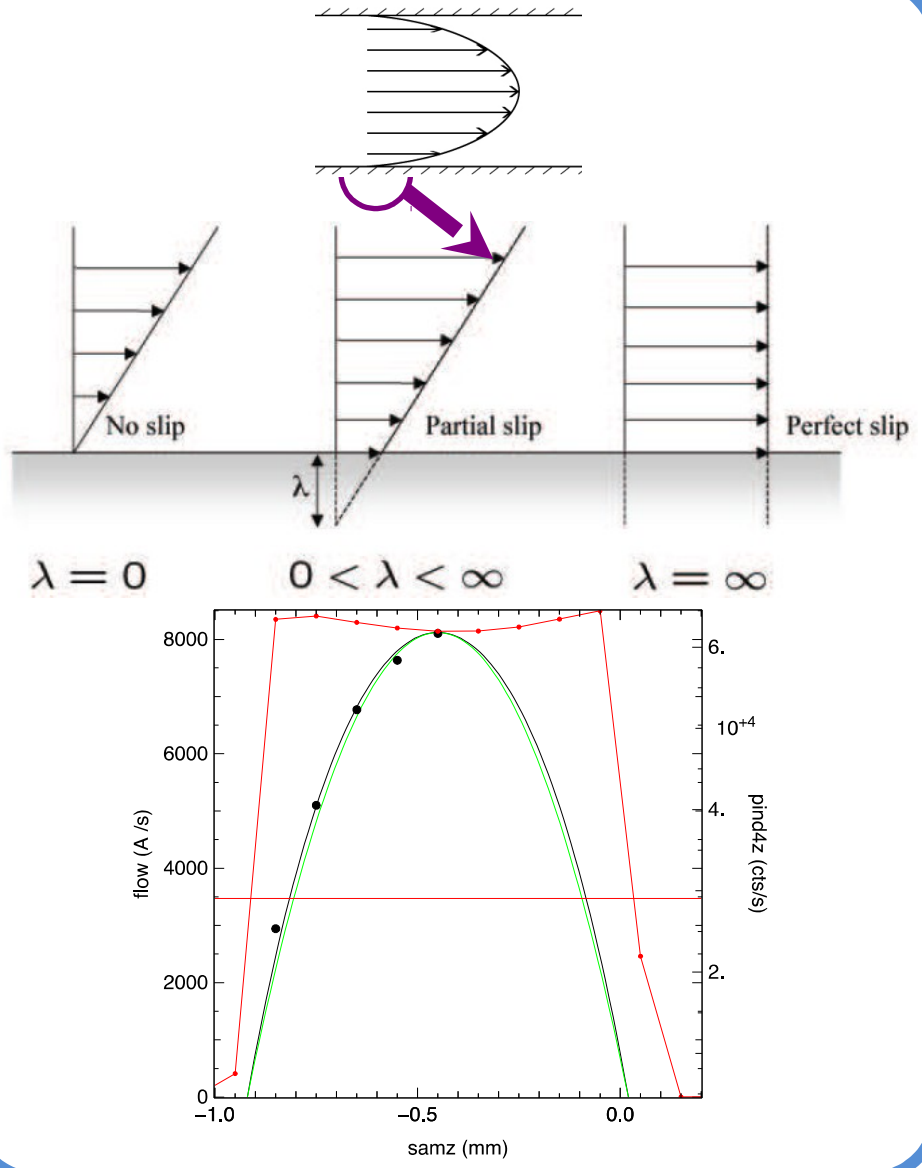
• 100x brilliance will expand the accessible dynamic range to microseconds, enabling probing the full dynamic evolution and fast



Sub-micron Flow Profiles

Opportunity

- Measure flow velocity profiles with sub-micron spatial resolution. Nanometer flow profiles are important to understand dynamics in materials.
  - Demonstration experiment: studying velocity boundary conditions at fluid-solid interface.



Challenge

- Coherence preserving sub-micrometer focusing to access the fluid/solid interface
- Limited coherent flux and coherent fraction to probe nanoscale dynamics

4GSR Strength

- Sub-micron focusing with

Nanoscale Dynamics and Macroscopic Rheology

Opportunity

- Linear and non-linear bulk rheology and its relation to nanoscale dynamics in complex fluids
- Shear induced velocity banding and flow instabilities in complex fluids
  - Highly sensitive probe of stress relaxation at the nanoscale as manifested in the non-equilibrium dynamics

Challenge

- Limited coherent fraction at high energies (20-30 keV) for shear cell and rheometer penetration
- Limited coherent flux and coherent fraction to probe nanoscale dynamics at micro-second time scales