Topics for discussion:

• What transport coefficients do we need?

• What do we know?

• Important problems

• How to make transport coefficients easily accessible for a broad NS community: ideas, suggestions
• What transport coefficients do we need?

• Cooling of isolated NSs and X-ray transients

• Oscillations of NSs

• Magnetic field evolution

• Vortex transport (glitches, inter-glitch dynamics)

• Dissipative effects during binary NS inspiral and post-merger phase (may affect GW signal)

• \( \kappa \)

• \( \eta, \xi \)

• \( D_{ij}, \sigma \)

• transport coefficients describing vortex-particle interactions

• \( \xi, \eta, \kappa \)

• ...?
• What do we know?

**Crust:**
- basic transport coefficients are rather well known $\kappa$, $\eta$, $\sigma$
  (but not in the pasta phase)

**Core:**
- As a rule, $n p e_\mu$ composition, no magnetic field, effects of superfluidity are partly taken into account
  - $\kappa$, $\eta$, $\xi$, $\sigma$
- diffusion coefficients in the magnetic field are only well known for a simplified nonsuperfluid model of *Yakovlev & Shalybkov (1991)*
- vortex-related transport coefficients are poorly known and controversial. The reliable result: mutual friction coefficient describing scattering of electrons off the vortex magnetic field.
Important problems

• Thermal and electrical conductivity in the pasta phases: important, e.g., for explaining magnetars

• Calculate diffusion tensor $D_{ij}$ with the updated microphysics

• Vortex transport

• Polarization properties of $npe\mu$-matter accounting for the Fermi-liquid effects and superfluidity/superconductivity (important for correctly describing the electron-electron and electron-proton scattering in dense Fermi-mixture).

• ...?
How to make transport coefficients easily accessible for a broad NS community: ideas, suggestions

- Fitting formulas
  (example: fits from the review by Schmitt & Shternin 2017)

  \[
  \eta_{e\mu} = 8.43 \times 10^{20} \left( \frac{n_B}{n_0} \right)^{14/9} \left( \frac{T}{10^8 \text{ K}} \right)^{-5/3} \frac{x_e^2 + x_\mu^2}{(x_e^{2/3} + x_\mu^{2/3} + x_p^{2/3})^{2/3}} \frac{\text{g}}{\text{cm s}}
  \]

  \[
  \eta_n = 2.15 \times 10^{17} \left( \frac{n_n}{n_0} \right)^{5/3} \left( \frac{m_n^*}{m_N} \right)^{-2} \left( \frac{T}{10^8 \text{ K}} \right)^{-2} \left[ \left( \frac{m_n^*}{m_N} \right)^2 m_\pi^2 S_{\eta nn} + \left( \frac{m_p^*}{m_N} \right)^2 m_\pi^2 S_{\eta np} \right]^{-1} \frac{\text{g}}{\text{cm s}}
  \]

- Tables

- Publicly available codes (example: library of Alexander Potekhin)

- ...?