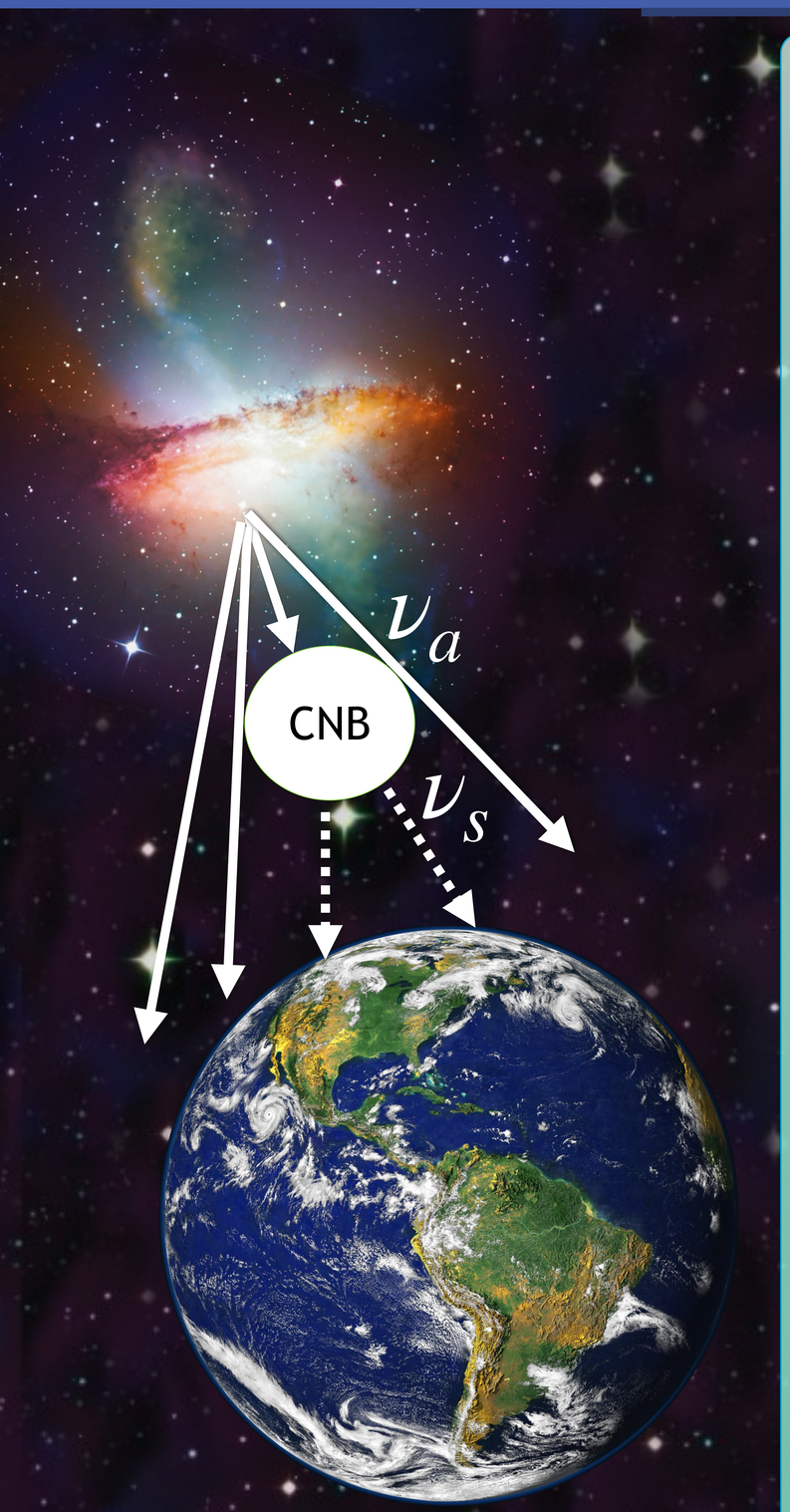
Astrophysical neutrinos under the effect of active-sterile secret interactions

D. Fiorillo, G.Miele, S.Morisi, N. Saviano
INFN Napoli, University of Naples



Model

- Extension of the Standard Model: sterile neutrinos interacting with the active ones through secret interactions

$$\mathscr{L} = -\sum_{\alpha} \lambda_{\alpha} \bar{\nu}_{\alpha} \gamma_5 \nu_s \phi$$

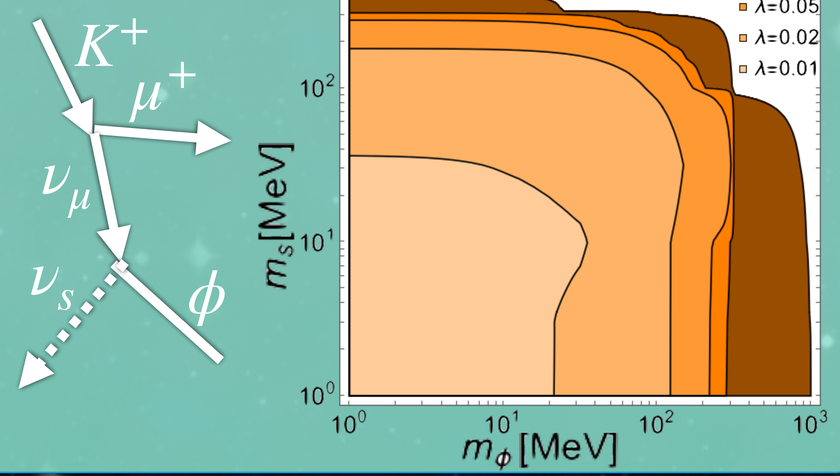
- Astrophysical active neutrinos collide with neutrinos from the Cosmic Neutrino Background (CNB) disappearing into sterile neutrinos

Cosmological constraints

- Sterile neutrinos and scalar particles must have large masses (above 10 MeV)

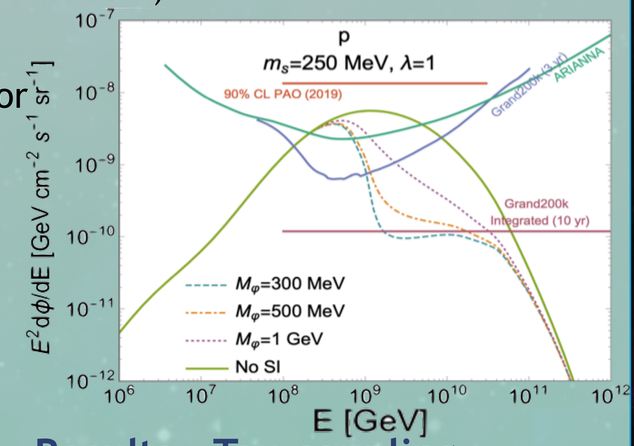
Laboratory constraints

- Secret interactions open new decay channels for the mesons, so the coupling is constrained by kaon decay



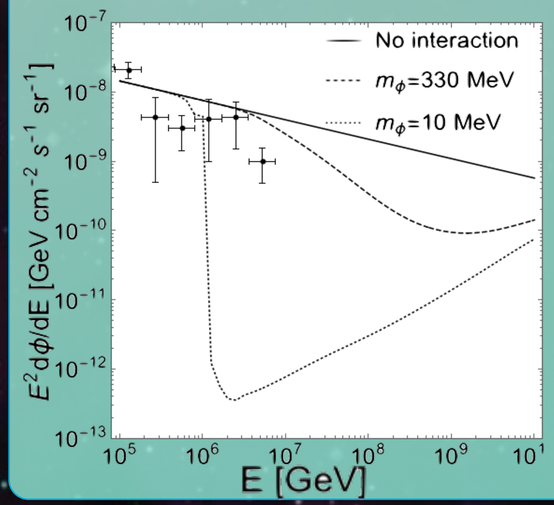
Results - Equal couplings

- If all neutrinos couple equally, kaon decay constrains the interaction: the effects are only important for high masses ($m_\phi, m_s \geq 250\,\mathrm{MeV}$)
- Absorption important for ultrahigh energy neutrinos, like cosmogenic neutrinos



Results - Tau coupling

- Since kaon cannot decay into tau leptons, the tau coupling is practically unconstrained, so we can choose smaller masses ($m_\phi, m_s \simeq 10\,\mathrm{MeV}$)



- Absorption important for PeV neutrinos from astrophysical sources
- We analyzed the effect on a benchmark power law

References

- D.F.G. Fiorillo, G. Miele, S. Morisi, N. Saviano, *Phys.Rev.D* 101 (2020) 8, 083024

Contacts

fiorillo@na.infn.it, miele@na.infn.it, morisi@na.infn.it, saviano@na.infn.it