

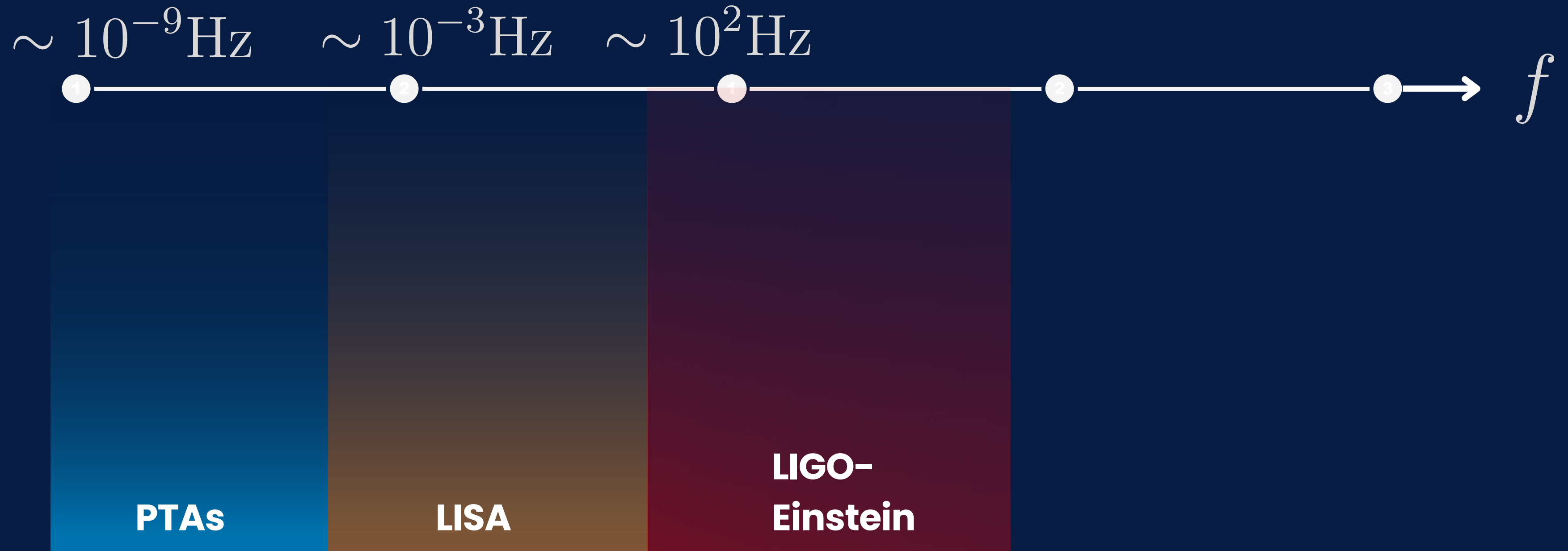
High Frequency GW Bounds from Galactic Neutron Stars

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Based on Arxiv [2402.14092]

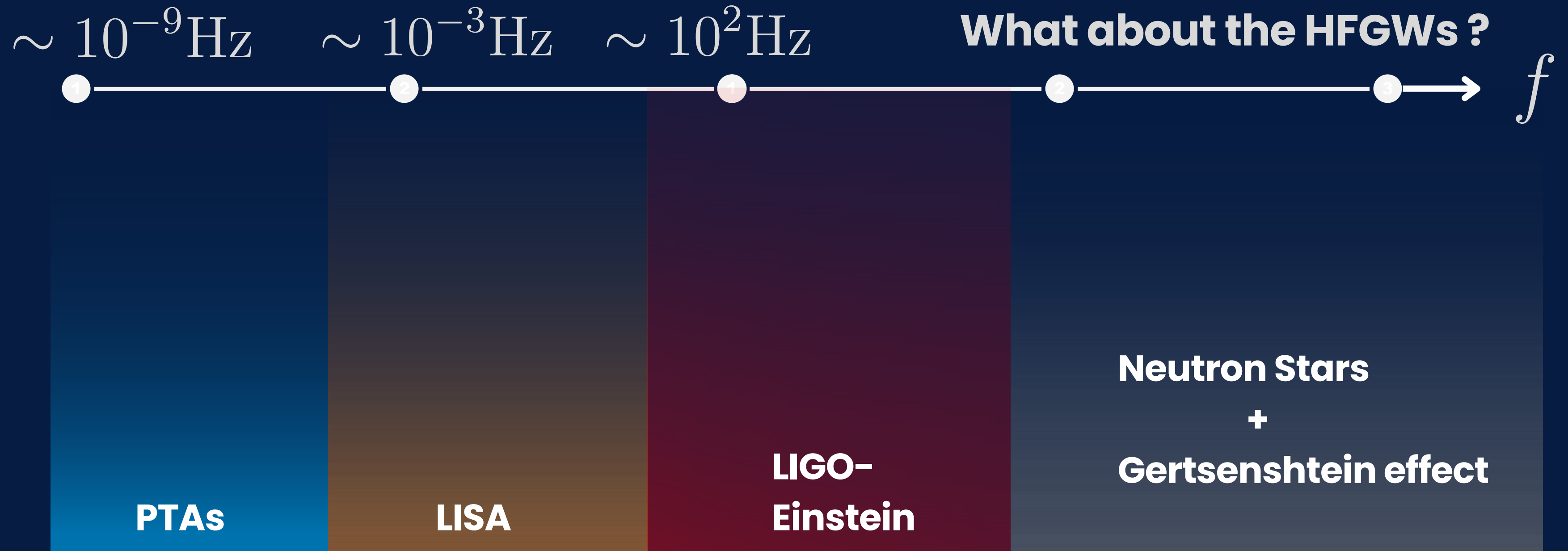
The Situation

What do we know about
the GW spectrum ?

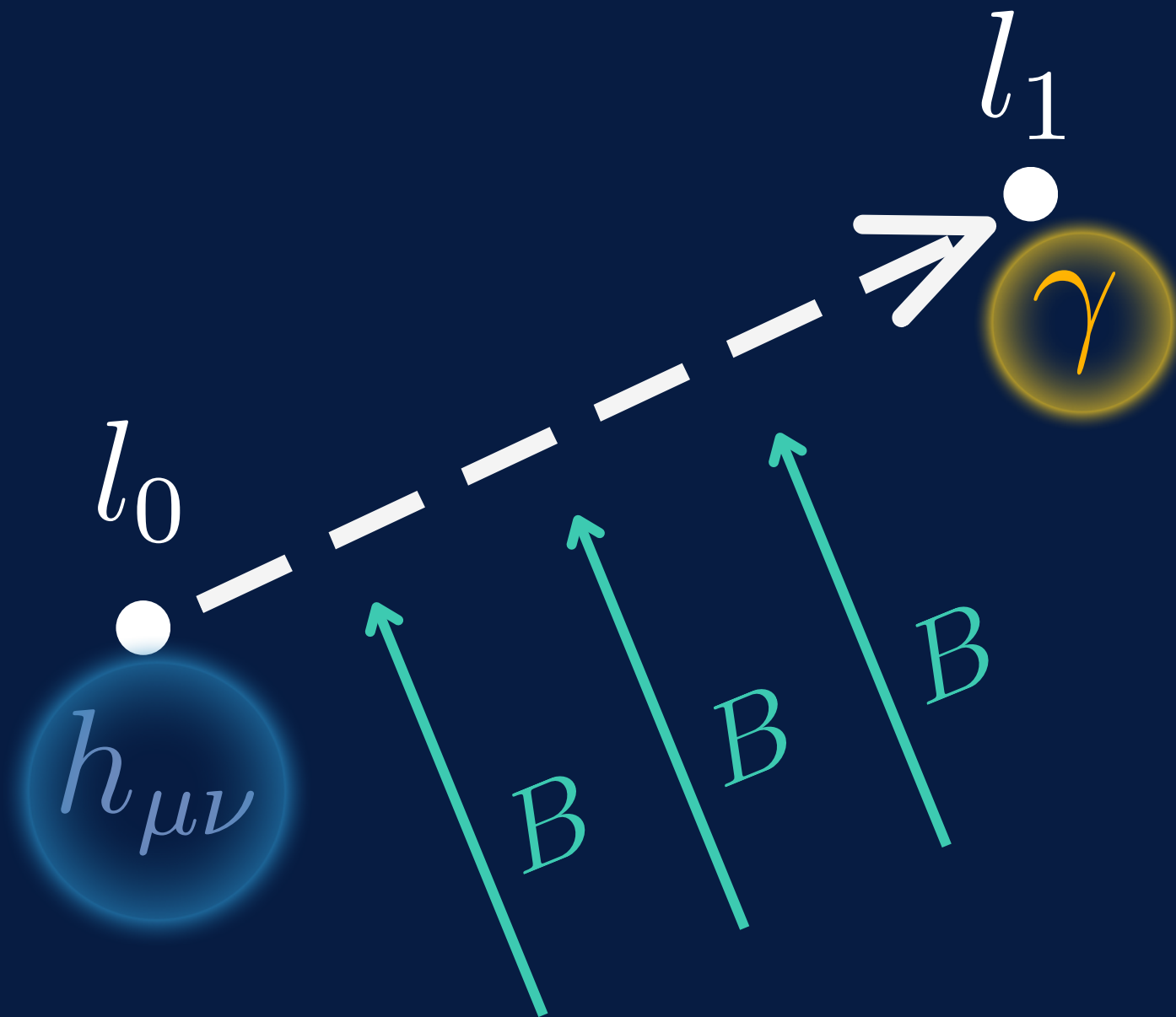


The Situation

What do we know about the GW spectrum?



The Gertsenshtein Effect



- GWs convert into photons in a strong magnetic field

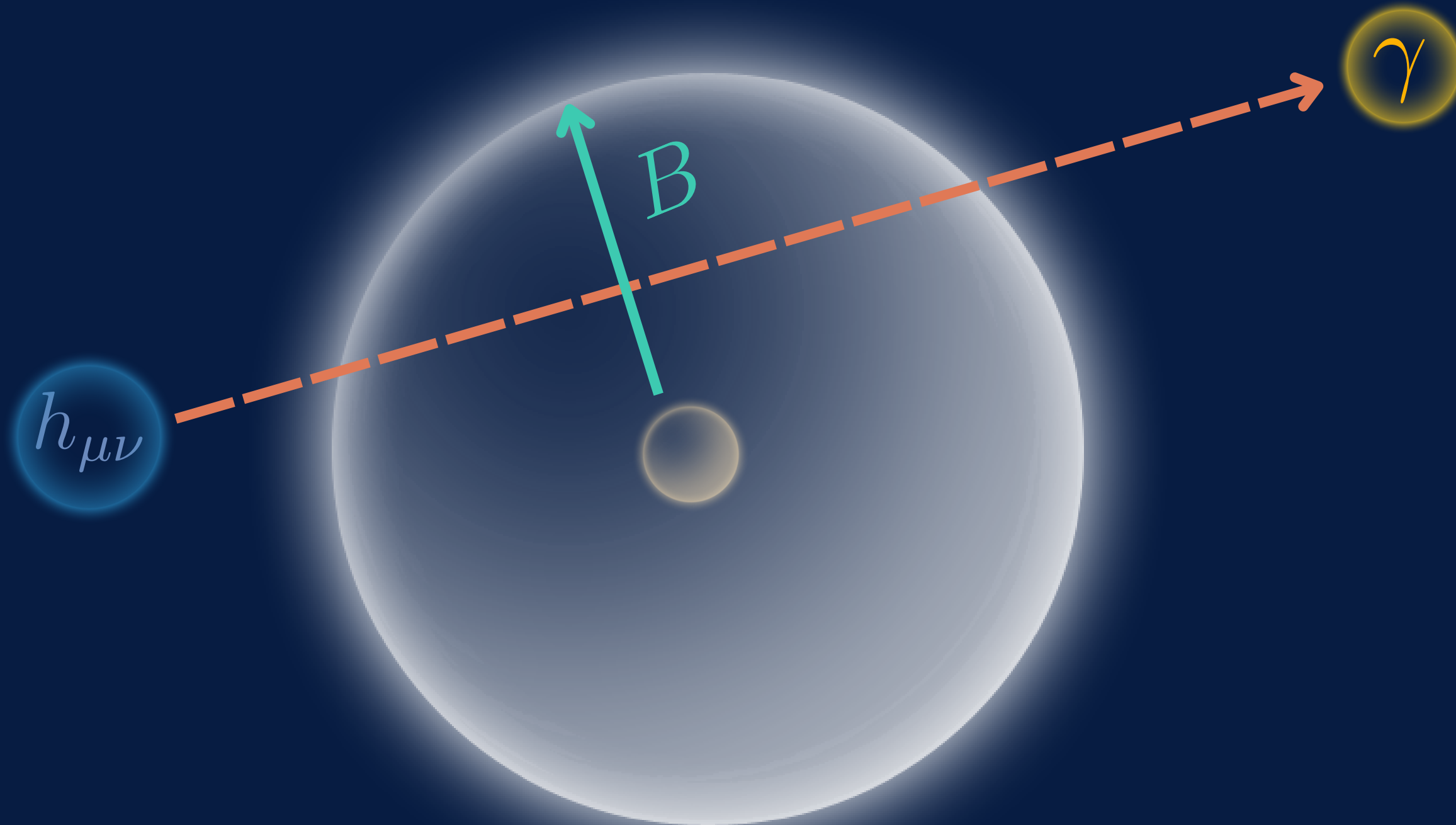
Conversion probability for gravitons travelling from l_0 to l_1 :

$$P_{g \rightarrow \gamma}(f) = \left| \int_{l_0}^{l_1} d\ell \Delta_M(\ell) \exp \left\{ -i \int_{l_0}^{\ell} d\ell' \Delta_\gamma(\ell') \right\} \right|^2$$

- The mixing term is $\Delta_M \sim B$
- Effective photon mass Δ_γ

(Gertsenshtein, 1962)
(Raffelt, Stodolsky 1987)

Conversion in NS magnetosphere



Typical Neutron Star

$$T \approx \mathcal{O}(1) \text{ s}$$

$$R \approx 10 \text{ km}$$

Magnetosphere

$$B(r) = B_0 (r/R)^{-3}$$

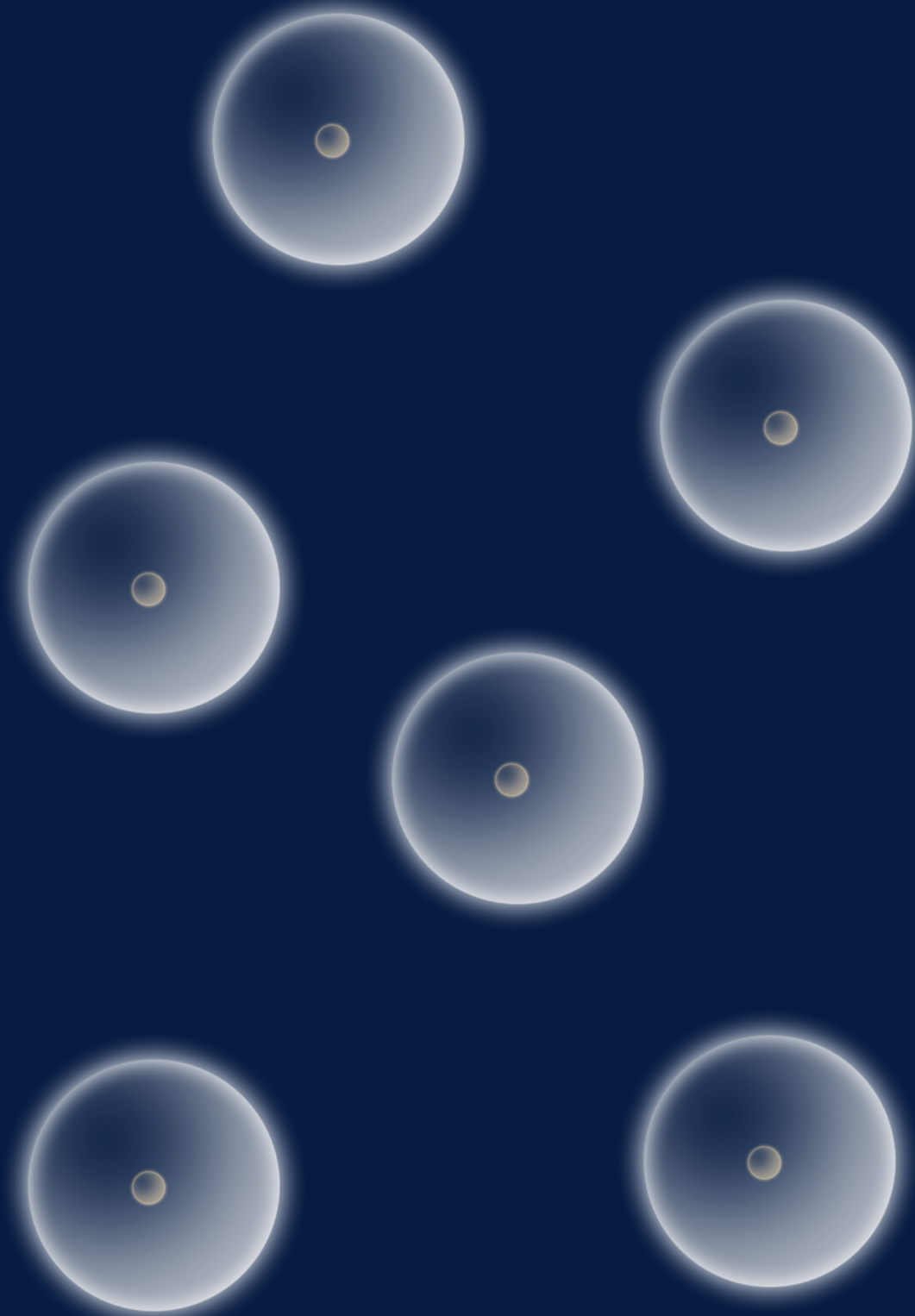
$$B_0 \approx 10^{13} \text{ Gauss}$$

The Idea

Conversion in NS magnetosphere

(Kaspi et al 2006)

(Popov et al 2010)



$$n_{\text{NS}}(\mathbf{r}) \quad P(T) \quad P(B_0)$$

Assuming a model for the galactic
neutron stars

The Idea

Conversion in NS magnetosphere

(Kaspi et al 2006)

(Popov et al 2010)



The diagram illustrates the concept of gravitational wave (GW) conversion in the magnetosphere of a neutron star (NS). It features a grid representing spacetime that is distorted by the presence of several neutron stars, depicted as glowing spheres with central cores. An orange arrow points from the magnetosphere region to a box containing the mathematical expression for the conversion process. A second orange arrow points from the bottom right of the diagram to the GW background parameters.

$$n_{\text{NS}}(\mathbf{r}) P(T) P(B_0)$$

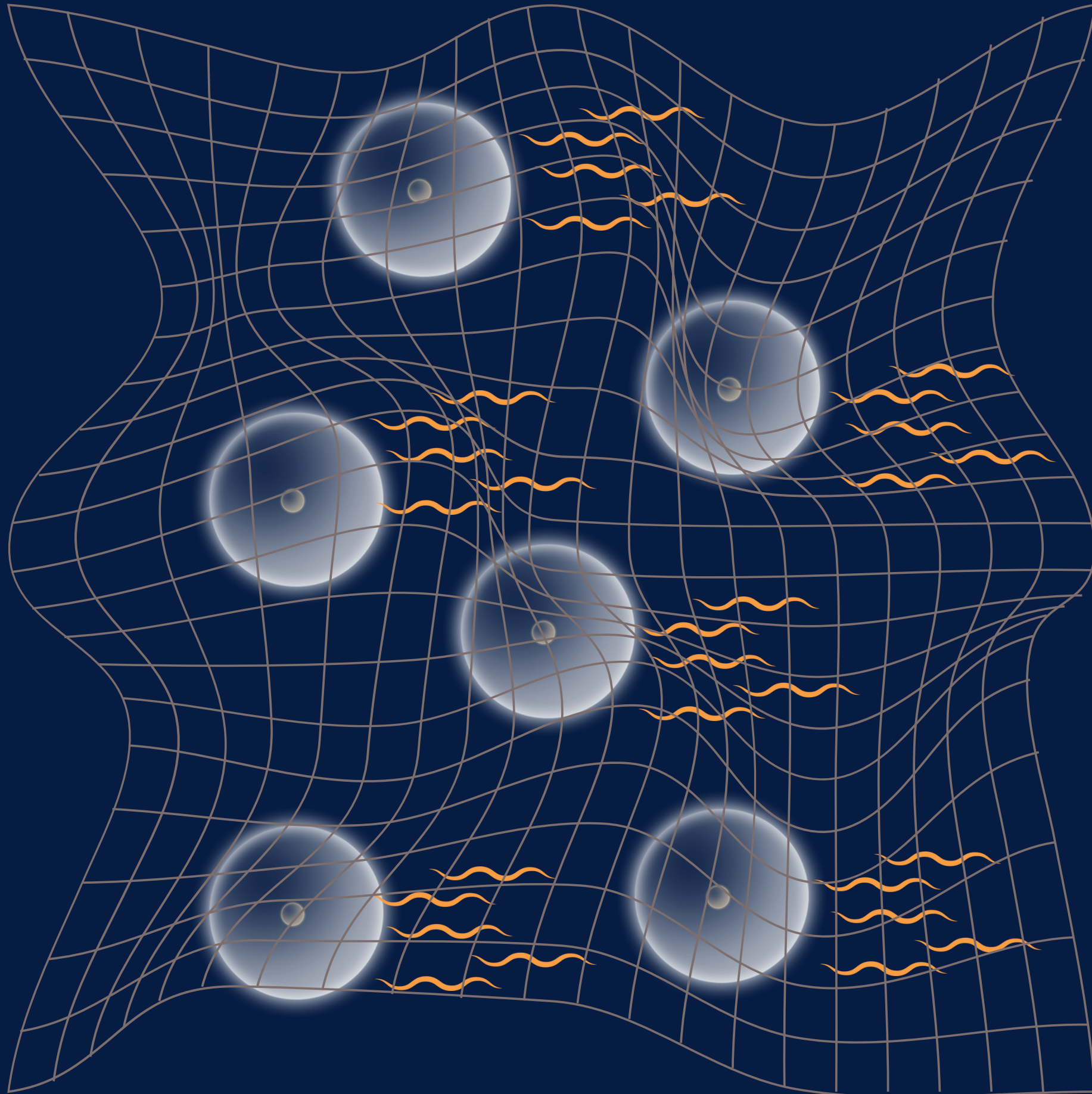
Assuming a model for the galactic neutron stars

GW background

$$f, h_c$$

The Idea

Conversion in NS magnetosphere

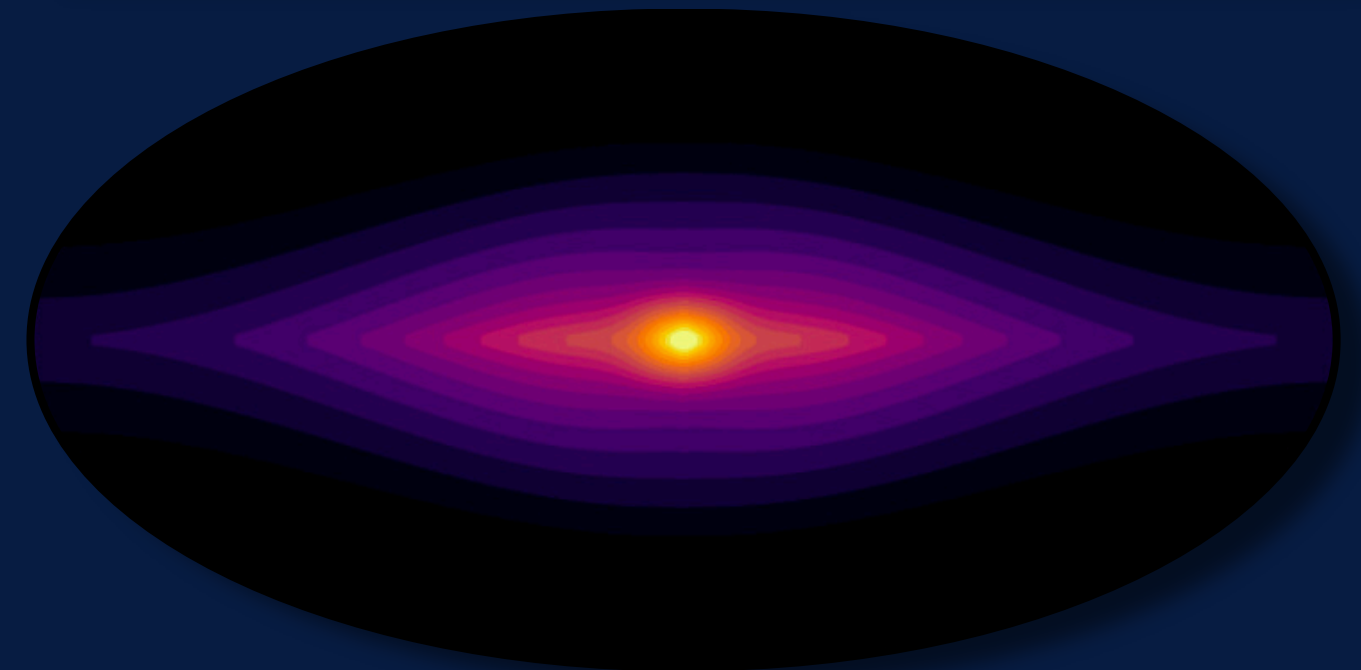


$$f = 10^{15} \text{ Hz}$$

$$h_c = 10^{-25}$$

$$\log \left(f \times \frac{\partial F_{\gamma}^{\text{galac.}}}{\partial f} \right) [\text{erg}/(\text{cm}^2 \text{s sr})]$$

-18.5 -18.0 -17.5 -17.0 -16.5



Constraints on the HFGW spectrum

