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# **Triadic resonances in the internal wave modes with background shear Patibandla B L V Ramana**<sup>1</sup>, Manikandan Mathur<sup>2</sup> and Anubhab Roy<sup>1</sup> <sup>1</sup> Department of Applied Mechanics, Indian Institute of Technology Madras, Chennai, India.

### Motivation

- □ Internal gravity waves (IGWs) are ubiquitous in the ocean and the atmosphere.
- Science 2003)
- "... dissipation mechanisms, together with the understanding of observed energy spectra resulting from nonlinear interactions between those waves is still debated."





(Garrett, Science 2003)



## Mathematical formulation

□ How does the background shear influence the resonant triad interactions of internal wave modes?

□ Assumptions:

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Inviscid Uniform stratification Finite-depth 2-D

□ We use a weakly-nonlinear theory:

$$L\psi(x, y, t) = \mathcal{N}\psi(x, y, t),$$

$$\psi = \psi_0 + \epsilon \psi_1 + \epsilon^2 \psi_2 + \dots,$$

$$L \psi_1 = 0$$
, at  $O(\epsilon)$ ,  
 $L \psi_2 = \mathcal{N} \psi_1$ , at  $O(\epsilon^2)$ .

 $\epsilon$  is a small parameter indicating the strength of nonlinearity

□ Primary monochromatic wave field:

$$\psi_1 = \sum_{j=-\infty}^{\infty} \frac{1}{2} \phi_j(z) e^{i(k_j x - \omega t)} + \text{c.c.},$$

• Exponential shear flow profile: (Young and Wolfe, JFM 2014)

$$egin{aligned} U(z) \,&=\,\delta\,\expigg(rac{z-1}{\xi}igg),\,0\leq\,z\leq\,1,\ \xi\,&=\,L_s/H,\quad\delta\,=\,U_s/NH\,=\,\xi/\sqrt{Ri}. \end{aligned}$$









