

Title: Physics in Nature Presentation: Computational Construction of Surface Gravity Wave Pictures

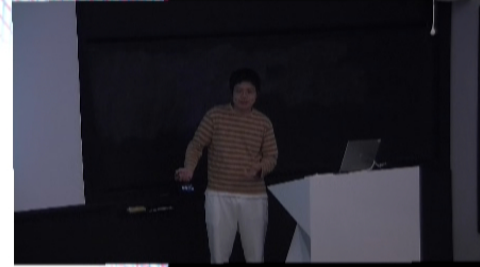
Date: Aug 19, 2011 03:00 PM

URL: <http://pirsa.org/11080116>

Abstract:

# Introduction

- Surface Gravity Wave
- Physics used: fluid mechanics, Fresnel's law in E&M
- Perspective (as in drawing)
- Numerical work



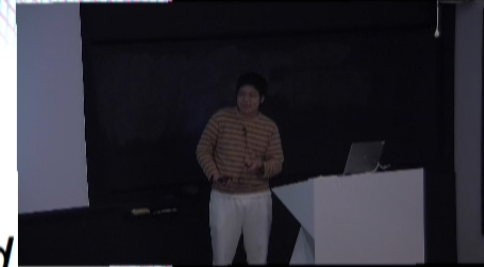
# 2D Surface Gravity Wave

- 1D case treated in P.Kundu & I. Cohen, *Fluid Mechanics*

$$\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial z^2} = 0$$
$$\frac{\partial \phi}{\partial z} = 0 \text{ at } z = -H$$
$$\frac{\partial \phi}{\partial z} = \frac{\partial \eta}{\partial t} \text{ at } z = 0$$
$$\frac{\partial \phi}{\partial t} = -g\eta \text{ at } z = 0$$

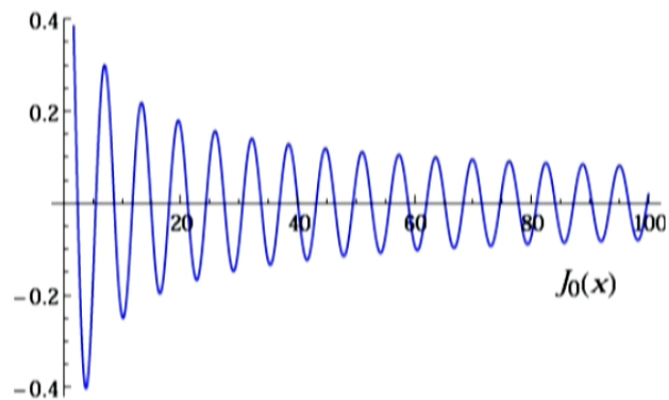
$\phi$ : "velocity potential"  $\eta$ : z value of boundary surface

- Generalization to 2D

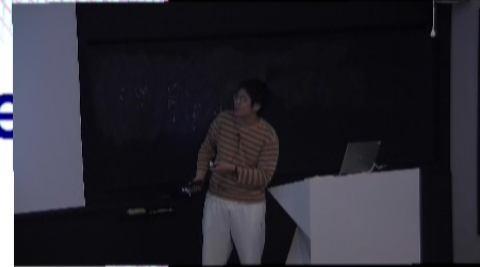


# Cylindrically Symmetric Wave

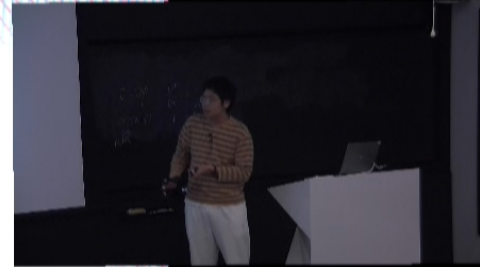
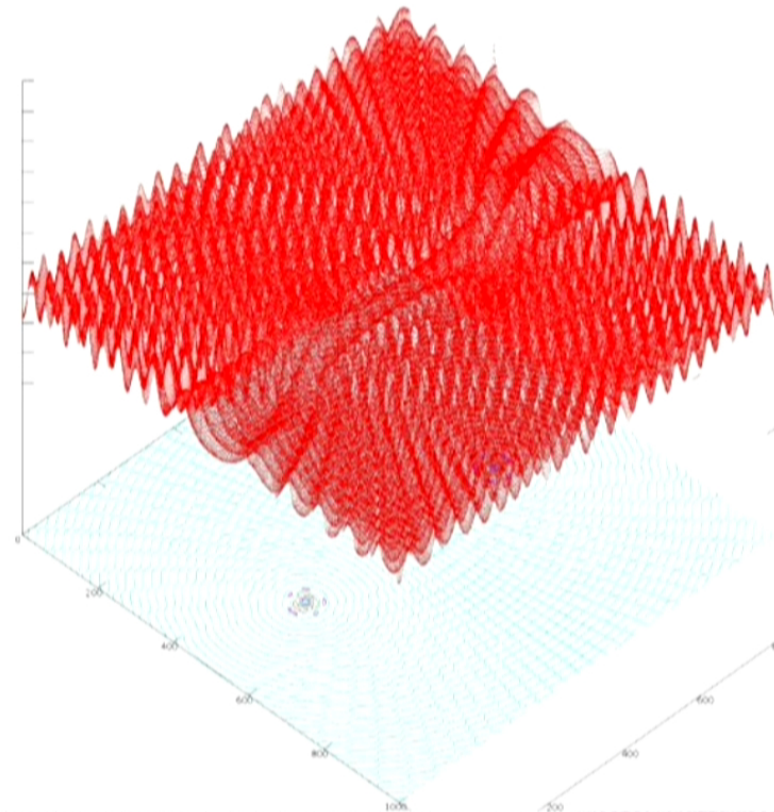
- Radial part: Bessel function  $J_0$
- Decay in -z direction
- Dispersion relation: phase velocity



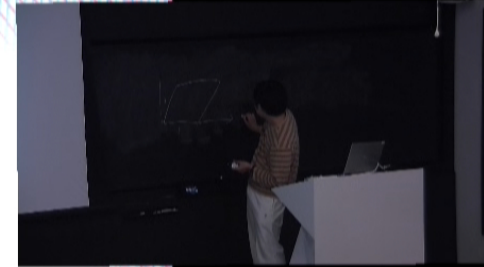
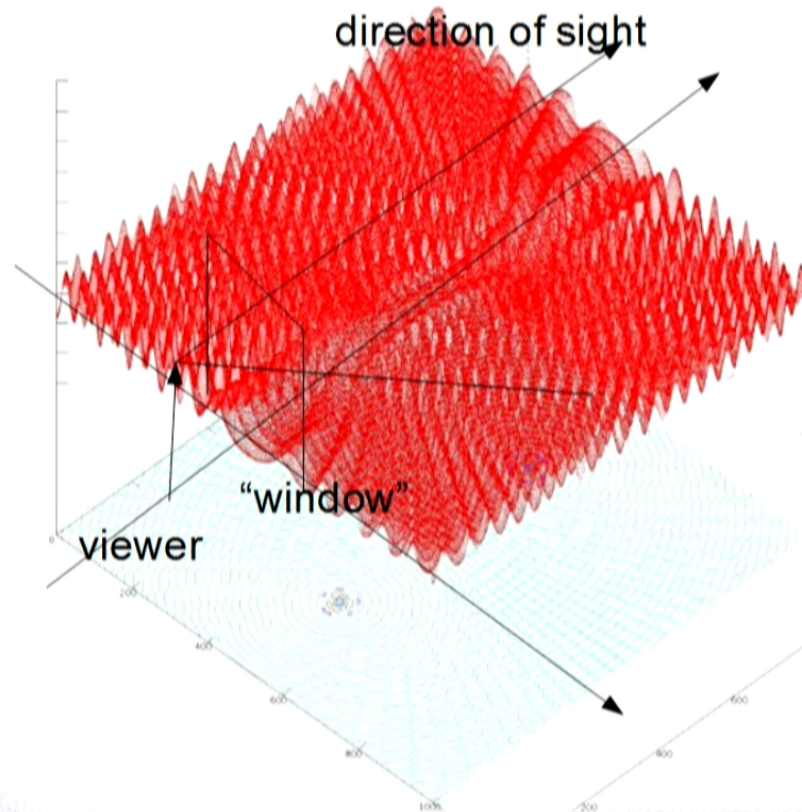
$$c = \sqrt{g/k}$$



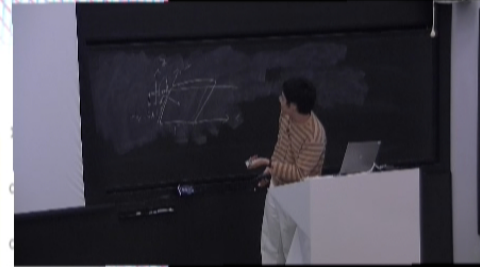
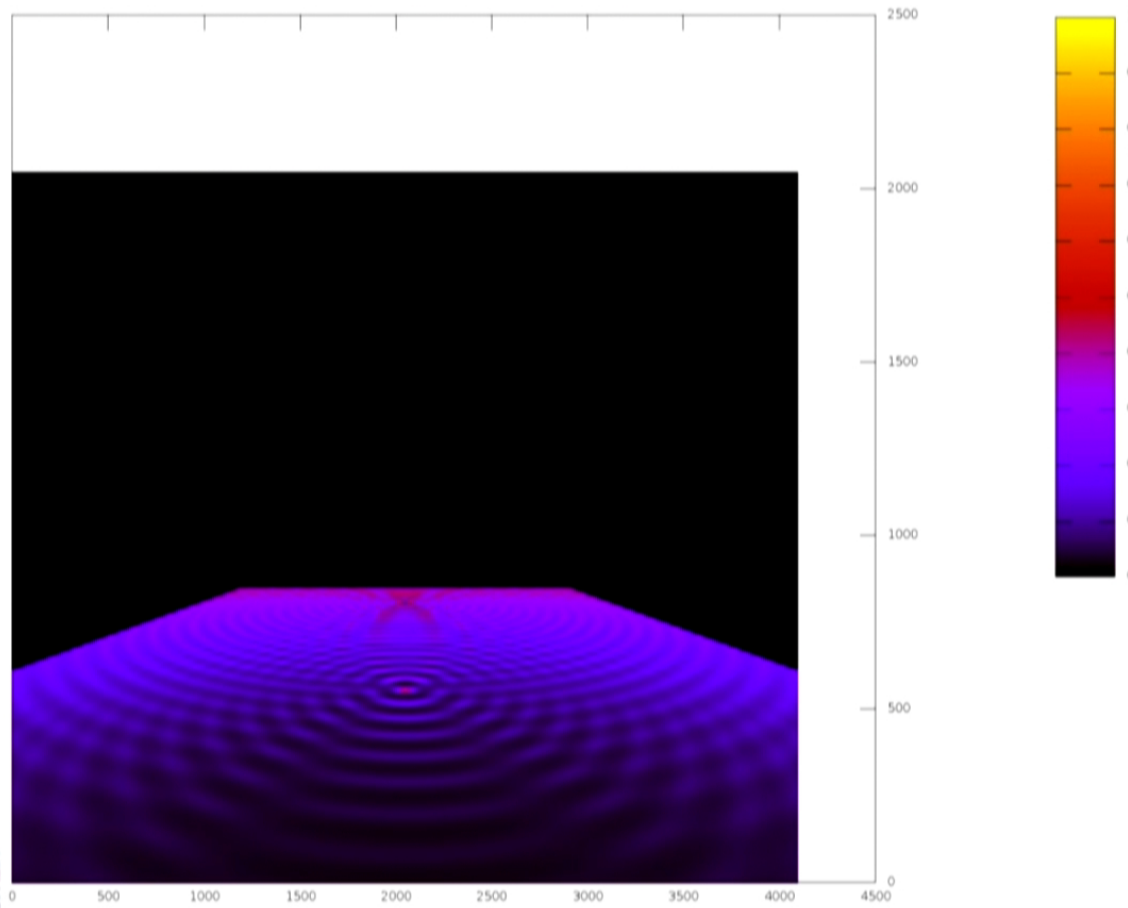
# Waveform Used



# Geometrical Configuration



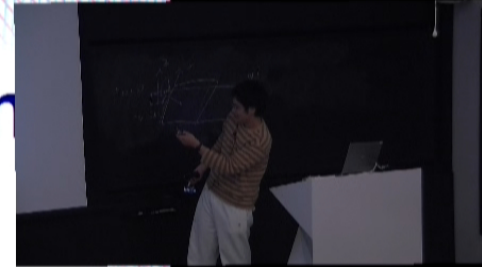
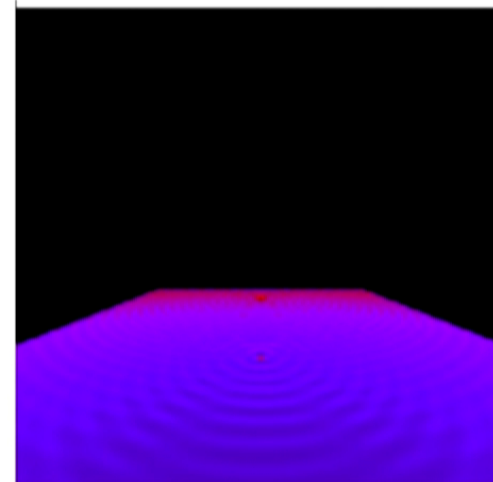
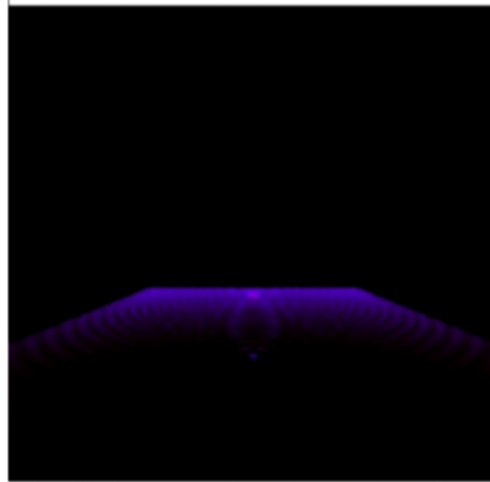
# Results



# Changing index of refraction

- $n=1.05$

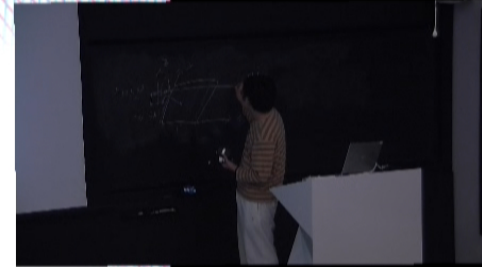
$n=2$





# What's next

- Change the direction of view
- More complicated waveform
- Background
- Interaction with air (wind)



# Thank you

- Questions?

