Experiment 4: Phase and Group velocity of EM waves

# Tools required:

# <http://demonstrations.wolfram.com/GroupAndPhaseVelocity/>

# Objective:

To understand the nature of EM waves travelling in a medium with the help of Phase and Group velocities.

# Observation table:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No** | | **Δω** | | **Δk** | | **Wave pattern of the resultant waves** | | **Vg** | |
| **1** | | **0.02** | | **0.02** | |  | | **1** | |
| **2** | | **0.06** | | **0.06** | |  | | **1** | |
| **3** | | **0.2** | | **0.2** | |  | | **1** | |
| **4** | | **0.5** | | **0.5** | |  | | **1** | |
| **5** | | **1.51** | | **0.13** | |  | | **11.6** | |
| **S. No** | | **Δω** | | **Δk** | | **Wave pattern of the resultant waves** | | **Vg** | |
| **6** | | **2.75** | | **0.6** | |  | | **4.58** | |
| **7** | | **3** | | **0.1** | |  | | **30** | |
| **8** | | **3** | | **0.4** | |  | | **7.5** | |
| **9** | | **-0.92** | | **0.24** | |  | | **-3.83** | |
| **10** | | **-2.45** | | **0.38** | |  | | **-6.45** | |

**Inferences:**

1. **Are the wave patterns for various values of Δω and Δk same? If not, why?**

No, the wave patterns for various values of Δω and Δk are not same even if Vg is same. The resultant wave formed by the superposition of two waves is dependent on the values of Δωand Δk. The resultant wave of the two waves is:

1. **Comment on the Phase velocity (Vp) of the waves for increased values of Δω and Δk.**

Phase Velocity (Vp) remains the same for a wave in a given medium. It does not get affected by the increased values of Δω and Δk.

1. **When do we see Vp and Vg being the same?**

If the phase velocity does not depend on the wavelength of the propagating wave, then

Vg = Vp. This happens in non-dispersive media.

1. **Draw a typical dispersion relation curve (ω-k curve) for Vp = Vg and Vp ≠ Vg cases.**

Vp = Vg – No dispersion

Vp ≠ Vg – Anomalous Dispersion and Normal Dispersion

