Wave Propagation and Dispersion

```
Clear["Global`*"];
Off[General::spell1];
```

- **Define a Gaussian wave packet of initial width σ_0 propagating in the +x direction with v=1. Assuming a dispersion relation of the form $\omega(k')$ ~ ωcarrier + vgroup (k') + $d\ (k')^2$, the width has a time dependence given by $\sigma_0 \sqrt{1 + \epsilon t^2}$, where $\epsilon = 4\ d^2 / \sigma_0^4$.**

```
σ[t_] = σ0 √(1 + ϵ t^2);

wave[x_, t_] = 1/(√(2 π) σ[t]) e^(-(x - v t)^2/(2 σ[t]^2));

val = {v → 1, σ0 → 1, ϵ → 0.01};
```

- **Make a movie by plotting the wave function as a function of x for successive values of t**

```
wplot[t_] := Plot[wave[x, t] /. val, {x, -5, 25},
   GridLines → Automatic, Frame → True, PlotRange → {{-5, 25}, {0, 0.5}},
   PlotStyle → {RGBColor[1, 0, 0]}, FrameLabel → {"x", "f"}, RotateLabel → False];

plotarray = Table[wplot[tp], {tp, 0, 20, 2}];
```