# Smooth Particle Hydrodynamics (SPH)

## Discretize Space with Interpolation Points

Define $\langle f \rangle$ by:

$$\langle f(r) \rangle = \int W(r-r',h)\, f(r')\, dr'$$

where $W(r,h)$ (Kernel) has the following properties:

$$\int W(r,h)dr = 1$$

and $\lim_{h\to 0} W(r-r',h) = \delta(r-r')$

Clearly, $\lim_{h\to 0} \langle f(r) \rangle = f(r)$

In fact, $\langle f(r) \rangle = f(r) + C\,(\nabla^2 f)h^2 + O(h^3)$

$\nabla^2 f$ is small if f is continuous

Dominant Errors are order $h^3$

$\langle f(r) \rangle : f(r) \rightarrow W(r-r',h) : \delta(r-r')$