Inflaton Fluctuations

- Single field *inflaton fluctuations* obey the linearized Klein-Gordon equation for $u = a \delta \phi$

$$\ddot{u} + \left[ k^2 - \frac{\ddot{z}}{z} \right] u = 0$$

where

$$z(\eta) = \frac{\dot{\phi}}{H}$$

- **Oscillatory response** to rapid slow down or speed up of roll $\dot{\phi}$ due to features in the potential

- Single function $z(\eta)$ controls *curvature fluctuations* but
  - direct PC or other functional constraints *cumbersome*
  - link to $V(\phi)$ obscured
Generalized Slow Roll

- **Green function approach** allowing slow roll parameters to be strongly *time varying* (Stewart 2002)

- Generalized for **large features** by promoting second order to *non-linear* in controlled fashion (Dvorkin & Hu 2009)

- Functional constraints on the **source function** of deviations from scale invariance

\[
G''(\ln \eta) = \frac{2}{3} \left[ \frac{f''}{f} - 3 \frac{f'}{f} - \left( \frac{f'}{f} \right)^2 \right], \quad f = 2\pi \eta z(\eta)
\]

- As long as large features are crossed on order an e-fold or less

\[
G' \approx 3 \left( \frac{V'}{V} \right)^2 - 2 \frac{V''}{V}
\]

same combination that enters into tilt $n_s$ in slow roll