

# BETWEEN FILAMENTATION AND TWO STREAM INSTABILITIES

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In the realm of beam-plasma interaction, filamentation as well as double-stream instabilities represent key issues in various physical settings ranging from astrophysical scenarios to the fast ignition scheme for inertial confinement fusion. These instabilities have been investigated for a long time and the corresponding growth rates are well documented including temperature, relativistic and collisions effects. The wave vector orientation however has always been considered strictly parallel or normal to the beam although reality is found back summing over every possible wave vector in the  $(\mathbf{k}, \omega)$  Fourier space.

We present an analytical study of unstable electromagnetic modes with arbitrarily oriented wave for a beam passing through a hot plasma with return current. We make the bridge between usual two-stream and filamentation instability across the  $\mathbf{k}$  space, and prove the existence of an intermediate orientation with important growth rates.