Title: Asymptotics of the canonical catastrophe integrals

Abstract: Catastrophe theory is a useful tool to describe certain natural phenomena in which smooth forces produce abrupt effects. It also useful in certain areas of optics, acoustics, and quantum mechanics. The main mathematical ingredient are the canonical catastrophe integrals [M. V. Berry and C. J. Howls, NIST Handbook of Mathematical Functions, cap. 36]. Unlike other special functions, little is known about the asymptotics of these integrals, because their highly oscillatory character makes the analysis difficult. In this talk we consider the simple canonical integrals of co-dimension K,

$$\Psi_K(x_1,...,x_K) := \int_{-\infty}^{\infty} \mathrm{e}^{\mathrm{i}[u^{K+2}+\sum_{m=1}^{K} x_m u^m]} du,$$

for large values of any one of their variables x_1,..., x_m, say x_p, and fixed values of the remaining ones. The standard *saddle point* method is not easy to apply because of the complicated integrand; then we use a simplified version introduced in [Lopez & all, 2009]. We derive the asymptotic approximation of these integrals for general values of the integers K and p in terms of elementary functions, as well as the Stokes lines. We observe that, for $p \neq 1$, this family of integrals has four different asymptotic behavior corresponding to four different regions, according to the even/odd character of the parameters K and p. The case $p = 1$ requires a different analysis. The asymptotic formulas so obtained could fill some gaps in Section 36.11 of the "NIST Handbook" devoted to the asymptotics of these integrals.