1047-81-447 **Jared C Bronski*** (jared@math.uiuc.edu), 1409 W Green St, Urbana, IL 61801, and **Zoi Rapti**, 1409 W Green St, Urbana, IL 61801. *Defect Eigenvalues and Diophantine Approximation.*

We consider an eigenvalue problem in one dimension with a potential consisting of a periodic piece together with a compactly supported defect. This defect may introduce an asymptotic phase shift in the periodic potential. We give a Maslov index argument for counting the number of point eigenvalues which are created in gaps in the essential spectrum. We establish upper and lower bounds which differ by at most two, and agree in many cases. As a consequence we prove the following result: the number of eigenvalues in large numbered gaps depends on the solvability of a certain Diophantine approximation problem. If this problem has no solutions then all but a finite number of gaps contain exactly one eigenvalue. If this problem has solutions then there exists a sequence of gaps (related to the solutions of the Diophantine approximation problem) which may contain up to 2 eigenvalues. This has implications for the Korteweg-DeVries equation with initial data which is asymptotically periodic. (Received February 03, 2009)