1084-53-86 **Tamas Darvas*** (tdarvas@math.purdue.edu), Department of Mathematics, Purdue University, 150 N. University Street, West Lafayette, IN 47907. *Morse theory and geodesics in the space of Kähler metrics.*

Given a compact Kähler manifold (X, ω_0) let $\mathcal{H}_0$ be the set of Kähler forms cohomologous to ω_0. As observed by Mabuchi, this space has the structure of an infinite dimensional Riemannian manifold, if one identifies it with a totally geodesic subspace of $\mathcal{H}$, the set of Kähler potentials of ω_0. Following Donaldson's research program, existence and regularity of geodesics in this space is of fundamental interest. In this paper, supposing enough regularity of a geodesic $u : [0,1] \to \mathcal{H}$, connecting $u_0 \in \mathcal{H}$ with $u_1 \in \mathcal{H}$, we establish a Morse theoretic result relating the critical points of $u_1 - u_0$ to the critical points of $\dot{u}_0 = du/dt|_{t=0}$. As an application of this result, we prove that on all Kähler manifolds, connecting Kähler potentials with smooth geodesics is not be possible in general. In particular, in the case $X \neq \mathbb{C}P^1$, we will also prove that the set of pairs of potentials that can not be connected with smooth geodesics has nonempty interior. (Received August 23, 2012)