1052-76-175 **Vladimir I. Zakharov*** (zakharov@math.arizona.edu). *Free Surface Hydrodynamics in Conformal Variables: New Results.*

We study the potential flow of a deep 2-D fluid with free surface in the presence of gravity. The fluid domain is conformally mapped onto the lower half-plane of the complex variable $w = u + iv$. If Φ is the hydrodynamic potential, in Dyachenko variables $R(w,t) = 1/z'$, $V(w;t) = i\partial\Phi/\partial z$, the Euler equations take an unusual but very elegant form. These equations are suitable both for analytical and numerical study. Analytical in the lower half-plane functions $R(w,t)$ and $V(w,t)$ have moving singularities in the upper half-plane. Zeros of $R(w,t)$ in the upper half-plane are also important. We are interested in the "robust" singularities only, which preserve their type with time. We will formulate a variety of rigorous analytical results about the nature of these singularities and their relationship to constants of the motion.

In spite of the progress, central questions of the theory are still unanswered: (A) Can singularity of the surface occur in a framework of exact equations in a finite time? (B) Are Euler equations for potential flow of deep fluid with free surface an integrable system?

The most plausible answer on both questions is positive. (Received August 26, 2009)