1154-31-124 **Stefan Steinerberger*** (stefan.steinerberger@gmail.com), 10 Hillhouse Avenue, New Haven, CT 06511. *A Nonlocal Transport Equation Describing Roots of Polynomials Under Differentiation.*

Let p_n be a polynomial of degree n having all its roots on the real line distributed according to a smooth function $u(0,x)$. One could wonder how the distribution of roots behaves under iterated differentation of the function, i.e. how the density of roots of $p_n^{(k)}$ evolves. We derive a nonlinear transport equation with nonlocal flux

$$u_t + \frac{1}{\pi}\left(\arctan\left(\frac{Hu}{u}\right)\right)_x = 0 \qquad \text{on } \operatorname{supp}\{u > 0\},$$

where H is the Hilbert transform. This equation has three very different compactly supported solutions: (1) the arcsine distribution $u(t,x) = (1-x^2)^{-1/2}\chi_{(-1,1)}$, (2) the family of semicircle distributions

$$u(t,x) = \frac{2}{\pi}\sqrt{(T-t)-x^2}$$

and (3) a family of solutions contained in the Marchenko-Pastur law. (Received August 12, 2019)