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**Eric Weber\*** ([esweber@iastate.edu](mailto:esweber@iastate.edu)), Department of Mathematics, 396 Carver Hall, Iowa State University, Ames, IA 50011, **Dorin Dutkay** ([dorin.dutkay@ucf.edu](mailto:dorin.dutkay@ucf.edu)), Department of Mathematics, University of Central Florida, Orlando, FL 32816, and **John Haussermann** ([jhaussermann@knights.ucf.edu](mailto:jhaussermann@knights.ucf.edu)), Department of Mathematics, University of Central Florida, Orlando, FL 32816. *Spectral Properties of Small Hadamard Matrices.*

A Hadamard matrix is a unitary matrix with entries which all have the same complex modulus. We endeavor to calculate the spectrum of a given Hadamard matrix. As a first step, we prove that if  $A$  and  $B$  are Hadamard matrices which are both of size  $4 \times 4$  or  $5 \times 5$  and in dephased form, then  $\text{tr}(A) = \text{tr}(B)$  implies that  $A$  and  $B$  have the same eigenvalues, including multiplicity. We calculate explicitly the spectrum for some subclasses of these matrices. We also extend these results to larger Hadamard matrices which are permutations of the Fourier matrix. (Received July 23, 2014)