Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

First experimental synthesis of $Al_{62}Cu_{31}Fe_7$ icosahedral quasicrystals and their natural origin in a meteorite by impact processes[1] PAUL ASIMOW, JINPING HU, CHI MA, Caltech, LUCA BINDI, Universit degli Studi di Firenze, Italy — Quasicrystals (QCs) produced by shock recovery experiments shine light on the impact origin of natural QCs in the Khatyrka meteorite [1,2]. $Al_{62}Cu_{31}Fe_7$ i-phase II is a newly found natural QC that has not previously been synthesized in the laboratory [3]. The compositions of Al-Cu-Fe QCs synthesized by shock have so far been similar but not identical to natural icosahedrite ($Al_{63}Cu_{24}Fe_{13}$) and i-$Al_{62}Cu_{31}Fe_7$ [3]. Here we present the results of a new shock recovery experiment using a compositionally graded Al-Cu-W wedge in a SS304 chamber. Surprisingly, the Al-rich region did not produce QCs whereas the intermediate Al-Cu mixture reacted with the steel chamber to generate i-$Al_{62}Cu_{30}Fe_7Cr_1$, co-existing with Al_2Cu (khatyrkite) and Al_3Cu_2 (stolperite) alloys. Conceivably, this results from the effects of shear flow during shock that stabilizes the new composition of icosahedral QC. More importantly, the synthesized i-phase II is a near-exact compositional, textural and assemblage match to its natural occurrence in the Khatyrka meteorite. [1] Asimow, P.D. *et al.* (2016) *PNAS*, 113, 7077. [2] Oppenheim, J. *et al.* (2017) *Sci. Rep.*, 7, 15629. [3] Bindi, L. *et al.* (2016) *Sci. Rep.*, 6, 38117.

[1]NASA 80NSSC18K0532

Paul Asimow
Caltech

Date submitted: 28 Feb 2019 Electronic form version 1.4