LIGHT NOBLE GASES AND A COSMIC RAY EXPOSURE AGE FOR THE BUNBURRA ROCKHOLE METEORITE. M.M.M. Meier[1], P.A. Bland[2], K.C. Welten[3], P. Spurný[4], H. Baur[1], R. Wieler[1]. [1]Institute of Isotope Geology and Mineral Resources, ETH Zurich, Switzerland meier@erdw.ethz.ch, [2]IARC, Department of Earth Science & Engineering, Imperical College, London, UK, [3]Space Sciences Laboratory, University of California, Berkeley, USA, [4]Astronomical Institute of the Academy of Sciences, Ondřejov Observatory, Czech Republic.

Introduction: We measured He, Ne and Ar in two ~50 mg samples of the Bunburra Rockhole meteorite. Preliminarily classified as a eucrite [1], this ungrouped achondrite [2] was found in October 2008, following an observation with the the Desert Fireball Network (DFN) in the Nullarbor region in Australia. It is the first achondrite with a known orbit and the first known meteorite from an Aten-type orbit [2, 3]. We report light noble gas concentrations and the cosmic ray exposure age of this meteorite. Cosmogenic radionuclides are given in [4].

Experimental: The meteorite chips were wrapped in aluminum foil and gases extracted at ~1800°C for ~10 min. Ar was analysed separately from He-Ne. Due to a high CO_2 background in the mass spectrometer, the CO_2++ correction on mass 22 was ~4%, while corrections for $H_2{}^{18}O$ and Ar^{40}++ on mass 20 were <0.2%.

Results and Discussion: Average gas concentrations are given in Table 1 only, as both samples are in good agreement. Assuming all ^{3}He and ^{21}Ne to be cosmogenic and after a slight correction for trapped Ar, the following cosmic ray exposure ages are obtained: 9.7 Myrs (^{3}He); 14.3 Myrs (^{21}Ne); 19.2 Myrs (^{38}Ar). These ages are based on shielding corrected (^{22}Ne/^{21}Ne = 1.08) production rates from [5] and the (eucrite-like) elemental composition given in [4]. We prefer the ^{21}Ne-age, because plagioclase-rich meteorites of eucritic composition are prone to He-loss on the order of 30% [5] and because ^{38}Ar exposure ages obtained on small samples are in general less accurate than ^{21}Ne ages due to heterogeneous Ca distribution. An exposure age of ~14 Myrs is not untypical for HED meteorites but would not correspond to a particularly pronounced exposure age peak observed for this clan. The low ^{22}Ne/^{21}Ne ratio suggests a quite large preatmospheric object, in contrast to the small radius derived from fireball data [3] and ^{36}Cl [4]. Additional radionuclide data [4] will be required to decide whether this may be explained by a complex exposure history of Bunburra Rockhole.

	^{3}He	^{20}Ne	^{21}Ne	^{22}Ne
BBR	1608	311.3	317.0	343.7
	^{36}Ar	^{38}Ar	*^{4}He*	*^{40}Ar*
BBR	239	281	*299300*	*144800*

Table 1 All Concentrations given in 10^{-10} ccSTP/g. Uncertainties: ~3% for concentrations, 0.5% for isotopic ratios.

References: [1] Bland P. et al. (2009) *Lunar Planet. Sci. Conf.*, 40, #1664. [2] Bland P. et al. (2009) *Meteorit. Planet. Sci.* (this volume), [3] Spurny P. et al. (2009) *Lunar Planet. Sci. Conf.*, 40, #1489. [4] Welten K.C. et al. (2009) *Meteorit. Planet. Sci.* (this volume), [5] Eugster O. and Michel Th., (1995), *Geochimica et Cosmochimica Acta*, 59:1,177-199.