S27a UNIONS Optical Identifications for VLASS Radio Sources in the Euclid Sky (UNVEIL) I. A Catalog of $\sim 146,000$ Radio Galaxies up to $z \sim 5$

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We present the results of optical identifications for Very Large Array Sky Survey (VLASS) radio sources employing the Ultraviolet Near Infrared Optical Northern Survey (UNIONS). A cross-match between UNIONS and VLASS Epoch 2 catalogs yields $146,212$ radio galaxies down to $r = 24.5$ mag over a wide area of $\sim 4,200$ deg^2 in the northern hemisphere. We perform $g-$dropout selections and find $\gtrsim 200$ sources at $z \sim 4$ optimistically. Of 63,019 sources with valid photometric redshifts, 8,692 are at $z_{\rm photo} \geq 1$ and 1,171 are at $z_{\rm photo} \geq 2$. Based on spectral luminosities at 1.4 and 3 GHz using the valid UNIONS photo-z, we identify $\sim 49,000$ radio-loud AGNs (RLAGNs) with $L_{1.4\rm GHz} > 10^{24}$ W Hz^{-1}, and all radio galaxies at $z \geq 1$ are RL. Adopting radio loudness instead, 138,266 out of 146,212 UNIONS-VLASS radio galaxies are RL. Thus, our catalog greatly increases the number counts of RLAGNs at $z > 1$. We further cross-match the UNIONS-VLASS catalog with LOw-Frequency ARray Two-metre Sky Survey (LoTSS) at 144 MHz and Faint Images of the Radio Sky at Twenty-cm (FIRST) at 1.4 GHz, yielding 101,671 UNIONS-VLASS-LoTSS, 79,638 -FIRST, and 64,672 -LoTSS-FIRST sources, respectively. This multifrequency radio dataset reveals sources of various spectral shapes, including the steep spectrum of aged populations, the peaked spectrum of young populations, and the upturned spectrum that might be associated with transient sources. The UNIONS-VLASS radio galaxy candidates will be covered by the Euclid wide survey, bringing about legacy values to benefit multi-faceted studies related to radio galaxies and beyond.