

## Refined line lists for the ions of ArH<sup>+</sup>, KrH<sup>+</sup> and XeH<sup>+</sup>

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Here we present refined ground state ( $X^1\Sigma^+$ ) line lists for the ions of ArH<sup>+</sup>, KrH<sup>+</sup> and XeH<sup>+</sup>. The various isotopologues considered are <sup>36</sup>ArH<sup>+</sup>, <sup>38</sup>ArH<sup>+</sup>, <sup>40</sup>ArH<sup>+</sup>, <sup>84</sup>KrH<sup>+</sup>, <sup>129</sup>XeH<sup>+</sup>, <sup>131</sup>XeH<sup>+</sup> and <sup>132</sup>XeH<sup>+</sup>. To date, <sup>36</sup>ArH<sup>+</sup> has been found in the Crab Nebula and both <sup>36</sup>ArH<sup>+</sup> and <sup>38</sup>ArH<sup>+</sup> have been detected in the direction of the lensed blazar PKS 1830 - 211. As far as we are aware neither KrH<sup>+</sup> or XeH<sup>+</sup> have been detected in space. *Ab initio* Potential Energy and Dipole Moment curves were calculated using MRCI/aug-cc-pVQZ level of theory and the former refined by fitting experimental data to an Extended Morse Oscillator to accuracies of  $\sim 0.60$  cm<sup>-1</sup> (ArH<sup>+</sup>) and  $\sim 0.0009$  cm<sup>-1</sup> (KrH<sup>+</sup>, XeH<sup>+</sup>). All line lists contain 400 states and 4000 - 7000 transitions covering appropriate vibrational and rotational states up to dissociation. Further work will now include adapting the Dipole moment curves to take into account the difference in position between centre of mass and centre of charge for these ions.

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