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Optical and Radio emissions of a possible blue starter observed by ASIM and the West Texas LMA

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This study reports on simultaneous optical and radio observations of a possible blue starter that took place in north-west Texas in the United States in 2018. The optical observations come from the Atmospheric-Space Interactions Monitor (ASIM) onboard the International Space Station [Neubert et al., 2019, doi: <https://doi.org/10.1007/s11214-019-0592-z>] and the radio observations were from the National Lightning Detection Network (NLDN) [Cummins and Murphy, 2009, doi: 10.1109/TEMC.2009.2023450] and the West Texas Lightning Mapping Array (WTLMA) [Chmielewski and Bruning, 2016, doi: <https://doi.org/10.1002/2016JD025159>]. It was identified by the ASIM CHU1 337 nm imager and shows a diffuse, conical emission shape reaching approximately 7 km above cloud top, characteristic of blue starters. The ASIM CHU2 777.4 nm imager shows a simple point-source of emissions, highly contrasting the 337 nm imager observations. The 337 and 777.4 nm photometers show four distinct pulses, the first two of which were dominated by the 337 nm emissions and also showed clear UV (180-230 nm) photometer peaks. From the WTLMA data, which clearly mapped the negative and positive leaders (or negative recoil events) even at low altitudes, the parent storm cell exhibited what appears to be a classic tri-polar charge structure, with upper and lower positive and middle negative charge. The blue starter occurs during what appears to be an initial ascending negative leader into the upper positive charge region, which continues to develop into a positive intracloud (IC) flash between the upper positive and middle negative charge region. During this time, there are several small NLDN positive cloud pulses (+IC), consistent with a traditional IC flash, but these are followed by two moderately high peak current (40-50 kA) negative cloud-to-ground strokes, which appear to be misclassified by the NLDN as there were no WTLMA VHF source points at low altitudes during this time. The misclassified negative strokes are concurrent with the first blue peak from the ASIM 337 nm photometer. We conjecture that these misclassified negative CG strokes were actually electromagnetic pulses from in-cloud (or near-cloud-top) sources, which were perhaps directly associated with the blue starter.