# Scientists model role of aerosol-photolysis interaction in winter haze formation

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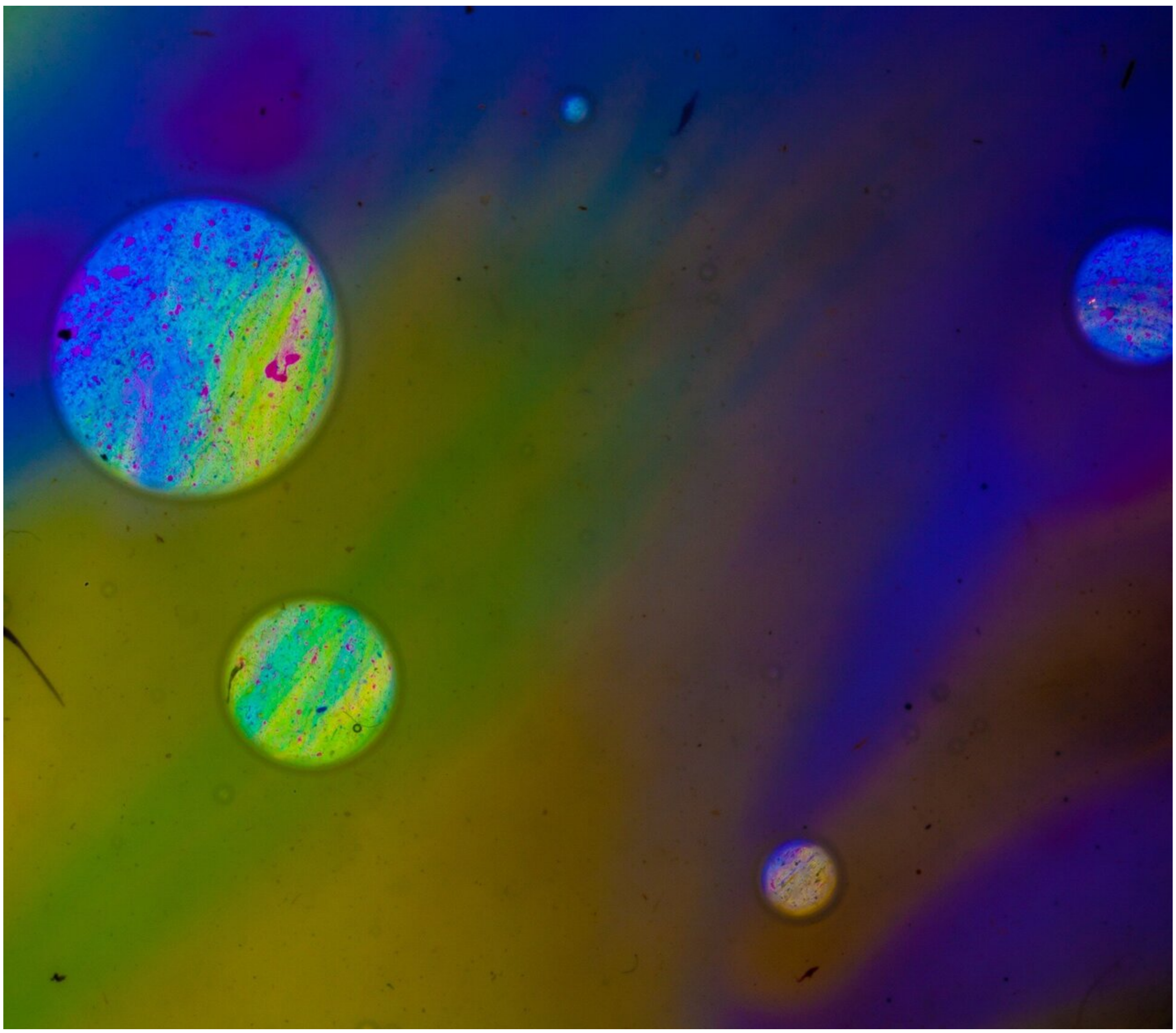

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A research team led by Prof. Li Guohui from the Institute of Earth Environment (IEE) of the Chinese Academy of Sciences quantitatively assessed how much PM2.5 could be attributed to the combination of ARI and API during a persistent heavy haze episode in the North China Plain in winter.

Aerosol-radiation interaction (ARI) includes direct scattering and/or absorption of incoming solar radiation by atmospheric aerosols and induced adjustments to the surface energy budget, thermodynamic profile and cloudiness.

ARI has been confirmed to cool the surface but heat the air aloft. It also enhances the atmospheric stability, accumulation and formation of fine particulate matter ($PM_{2.5}$) in the planetary boundary layer (PBL), and eventually deteriorates air quality during haze events.

However, modification of photolysis in the atmosphere caused by aerosols absorbing or scattering solar radiation (i.e., the aerosol-photolysis interaction, or API) ultimately changes ozone ($O_3$) formation and atmospheric oxidizing capability (AOC), further influencing secondary aerosol formation and offsetting ARI effects on $PM_{2.5}$ pollution.

Recently, a research team led by Prof. Li Guohui from the Institute of Earth Environment (IEE) of the Chinese Academy of Sciences quantitatively assessed how much $PM_{2.5}$ could be attributed to the combination of ARI and API during a persistent heavy haze episode in the North China Plain in winter.

The study was conducted from a modeling perspective with a combination of measurements. It was published in *PNAS* on Apr. 14.

Based on observations, the researchers found that secondary aerosols constituted a major fraction of $PM_{2.5}$ in Beijing, and were determined to a large extent by atmospheric oxidants affected by API.

The results of the study indicated that API caused the daytime $NO_2$ photolysis rate constant and $O_3$ concentrations to decrease by 22.6% and 18.6%, respectively.

"Such a pronounced decrease of AOC will inevitably impede secondary aerosol formation. Actually, the API effect on secondary aerosol formation could be observed indirectly from analyses of measurements through its impact on $O_3$," said Prof. Li.

The researchers found that ARI contributed to a 7.8% increase in near-surface $PM_{2.5}$. However, API suppressed secondary aerosol formation. As a result, the combination of ARI and API resulted in only a 4.8% net increase in $PM_{2.5}$, with almost 60% of the $PM_{2.5}$ enhancement due to ARI only.

"The total aerosol effect on radiation—that is, the synergetic effect of both ARI and API—does not constitute an important factor in driving heavy haze formation, except for extremely severe haze," said Prof. LI.

**More information:** Jiarui Wu et al, Aerosol–photolysis interaction reduces particulate matter during wintertime haze events, *Proceedings of the National Academy of Sciences* (2020). DOI: 10.1073/pnas.1916775117

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