

HIRAM CASTILLO-MICHEL, Ph.D.

PRESENT POSITION

Beamline Scientist
X-ray microscopy beamline ID21
European Synchrotron Radiation Facility
B.P.220 - 38043 GRENOBLE Cedex, France
tel : 33 (0)4 76 88 29 48
fax : 33 (0)4 76 88 27 85

EMAIL ADDRESS

castillo@esrf.fr

Research interests: Application of synchrotron μ XRF/ μ XANES for the study of the distribution and biochemical modification of trace elements and nanomaterials in the environment. In particular, I am interested in the fate and transport of nanomaterials and potentially toxic elements in agricultural systems. Since plants are part of the first trophic level, they are a main route of entrance of toxic elements in the food chain. These toxic elements and nanomaterials are environmental stressors at the tissue and cellular level, disrupting important biochemical functions in living organisms. The specific localization and chemical form of these stressors at the tissue and subcellular level are the main objects of my research.

EDUCATION

European Synchrotron Radiation Facility

Post-doctoral fellow

Feb 2011 – Jul 2013

University of Texas at El Paso, El Paso, Texas

Ph.D., Environmental Science and Engineering

Graduation: May 2011

Dissertation: "Accumulation, speciation, and distribution of metal(loids) in plants: Applications of synchrotron techniques in environmental sciences"

University of Texas at El Paso (UTEP), El Paso, Texas

M.S., Analytical/Environmental Chemistry

Graduation: December 2005

Thesis: "Biochemical Aspects of Chromium and Arsenic Uptake by Peas (*Pisum sativum*): Effect on Amylase Activity and Elemental Reduction"

Universidad Autonoma de Chihuahua, Mexico

B.S., Chemical Engineering

Graduation: December 2002

PEER-REVIEWED PUBLICATIONS and PROCEEDINGS

Citation indices	All	Since 2016
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2021

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98. Muccifora, S., Castillo-Michel, H., Barbieri, F., Bellani, L., Ruffini-Castiglione, M., Spano, C., Pradas del Real, A.E., Giorgetti, L., Tassi, E. Synchrotron Radiation Spectroscopy and Transmission Electron Microscopy Techniques to Evaluate TiO₂ NPs Incorporation, Speciation, and Impact on Root Cells Ultrastructure of *Pisum sativum* L. Plants. *Nanomat.* 2021 <https://doi.org/10.3390/nano11040921>
97. Álvarez-Marimon, E., **Castillo-Michel, H.**, Reyes-Herrera, J., Seira, J., Aso, E., Carmona, M., Ferrer, I., Cladera, J., Benseny-Cases, N. Synchrotron X-ray Fluorescence and FTIR signatures for Amyloid Fibrillary and non-fibrillary Plaques. *Chem. Neurosci.* 2021
96. Mendoza-Chávez, Y.J., U-Castillo, J.L., Cervantes-Martínez, A., Gutiérrez-Aguirre, M., **Castillo-Michel, H.**, Loredó-Portales, R., SenGupta, B., Martínez-Villegas, N.V., *Paracyclops chiltoni* inhabiting water highly contaminated with arsenic: Water chemistry, population structure, and arsenic distribution within the organism. *Environ. Pollut.*, 2021. <https://doi.org/10.1016/j.envpol.2021.117155>
95. Larue, C., Sarret, G., **Castillo-Michel, H.A.**, Pradas del Real, A. A Critical Review on the Impacts of Nanoplastics and Microplastics on Aquatic and Terrestrial Photosynthetic Organisms. *Small*, 2021. <https://doi.org/10.1002/smll.202005834>
94. Savassa, S., **Castillo-Michel, H.**, Pradas del Real, A.E., Reyes-Herrera, J., Marques, J., De Carvalho, H. Ag nanoparticles enhancing *Phaseolus vulgaris* seedling development: understanding nanoparticle migration and chemical transformation across the seed coat. *Environ. Sci.: Nano*, 2021. <http://dx.doi.org/10.1039/D0EN00959H>

2020

93. Longo, A., Shale, C., Glatzel, P., Giacobbe, C., Rack, A., Mathon, O., Lomachenko, K., Segura-Ruiz, J., Villanova, J., Castillo-Michel, H., Vanpeene, V., Tucoulou, R., Shulli, T., Martens, I., Drnec, J. Energy and Environmental Sciences at ESRF. *Synchrotron Rad. News*, 2020. <https://doi.org/10.1080/08940886.2020.1812357>
92. Pongrac, P., **Castillo-Michel, H.**, Reyes-Herrera, J., Hancock, R.D., Fischer, S., Kelemen, M., Thompson, J., Wright, G., Likar, M., Broadley, M., Vavpetic, P., Pelicon, P., White, P., Effect of phosphorus supply on root traits of two *Brassica oleracea* L. genotypes. *BMC Plant Biol.*, 2020. <https://doi.org/10.1186/s12870-020-02558-2>
91. Vogel, C., Helfestein, J., Massey, M.S., Sekine, R., Kretzchmar, R., Beiping, L., Peter, T., Chadwick, O.A., Tamburini, F., Rivard, C., Herzel, H., Adam, C., Pradal del Real, A., **Castillo-Michel, H.**, Zuin, L., Wang, D., Felix, R., Lassalle-Kaiser, B., Frossard, E. Microspectroscopy reveals dust-derived apatite grains in acidic, highly-weathered Hawaiian soils. *Geoderma*, <https://doi.org/10.1016/j.geoderma.2020.114681>
90. Pradas del Real, A., Perez-Sanz, A., Garcia-Gonzalo, P., Castillo-Michel, H., Gissera, M.J., Lobo, M.C. Evaluating Cr behaviour in two different polluted soils: Mechanism and implications for soil functionality. <https://doi.org/10.1016/j.jenvman.2020.111073>
89. Roman, M., Rigo, C., **Castillo-Michel, H.**, Urgast, D., Feldmann, J., Munivrana, I., Vindigni, V., Micetic, I., Benetti, F., Barbante, C., Cairns, W. Spatiotemporal distribution and speciation of silver nanoparticles in the healing wound. *Analyst*, <https://doi.org/10.1039/D0AN00607F>
88. Cruz-Jimenez, G., Loredó-portales, R., Del Río-Salas, R., Moreno-Rodríguez, V., **Castillo-Michel, H.**, Ramiro-Bautista, L.R., Aquilanti, G., De la Rosa-Alvarez, G., Rocha-Amador, D. Multi-synchrotron techniques to constrain mobility and speciation of Zn associated with historical mine tailings. *Chem. Geol.* <https://doi.org/10.1016/j.chemgeo.2020.119866>
87. Escudero, V., Abreu, I., Tejada-Jimenez, M., Rosa-Nunez, E., Quintana, J., Prieto, R.I., Larue, C., Wen, J., Villanova, J., Mysore, K., Arguello, J.M., **Castillo-Michel, H.**, Imperial, J., Gonzalez-Guerrero, M. *Medicago truncatula* Ferroportin 2 mediates iron import into nodule symbiosomes. *New Phytologist*. <https://doi.org/10.1111/nph.16642>
86. Vogel, C., Sekine, R., Huang, J., Steckenmesser, D., Steffens, D., Huthwelker, T., Borca, C., Pradas del Real, A.E., **Castillo-Michel, H.**, Adam, C. Effects of nitrification inhibitor on nitrogen species in the soil and the yield and phosphorus uptake of maize. *Science of the total environment*. <https://doi.org/10.1016/j.scitotenv.2020.136895>
85. Moros, M., Di Maria, F., Dardano, P., Tommasini, G., **Castillo-Michel, H.**, Kovtun, A., Zangoli, M., Blasio, M., Tino, A., Barbarella, G., Tortiglione, C. In vivo bioengineering of fluorescent conductive protein-dye microfibers. *iScience*. <https://doi.org/10.1016/j.isci.2020.101022>

84. Pongrac, P., Arcon, I., **Castillo-Michel, H.**, Vogel-Mikus, L., (2020) Mineral element composition in grain of awned and awnleted wheat (*Triticum aestivum L.*) cultivars: Tissue-specific speciation and phytate and non-phytate ligand ratio. *Plants* <https://doi.org/10.3390/plants9010079>
83. Escudero, V., Abreu, I., del Sastre, E., Tejada-Jimenez, M., Larue, C., Novoa-Aponte, L., Wen, J., Mysore, K., Abadia, J., Arguello, J.M., **Castillo-Michel, H.**, Alvarez-Fernandez, A., Imperial, J., Gonzalez-Guerrero, M. Nicotianamine Synthase 2 Is Required for Symbiotic Nitrogen Fixation in *Medicago truncatula* Nodules. (2020) *Frontiers Plant Sci.* <https://dx.doi.org/10.3389/fpls.2019.01780>
82. Roubeau Dumont, E., Larue, C., **Castillo-Michel, H.**, Gryta, H., Line, C., Baque, D., Gross, E.M., Elger, A. (2020) Genotypes of the aquatic plant *Myriophyllum spicatum* with different growth strategies show contrasting sensitivities to copper contamination. *Chemosphere* <https://doi.org/10.1016/j.chemosphere.2019.125552>
81. Yan, B., Isaure, M.P., Mounicou, S., **Castillo-Michel, H.**, De Nolf, W., Nguyen, C., Cornu, J.Y. (2020) Cadmium distribution in mature durum wheat grains using dissection, laser ablation-ICP-MS and synchrotron techniques. *Environ. Pollut.* <https://doi.org/10.1016/j.envpol.2020.113987>
80. Barraza-Garza, G., Perez-Leon, J.A., **Castillo-Michel, H.A.**, de la Rosa, L.A., Martinez-Martinez, A., Cotte, M., Alvarez-Parrilla, E., (2020) Antioxidant effect of phenolic compounds (PC) at different concentrations in IEC-6 cells: A spectroscopic analysis. *Spectrochim. Acta A.* <https://doi.org/10.1016/j.saa.2019.117570>

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79. Penen, F., Isaure, M.P., Doboritzsch, D., **Castillo-Michel, H.**, Gontier, E., Le Costumer, P., Malherbe, J., Schaumloffel, D., (2019) Pyrenoidal sequestration of cadmium impairs carbon dioxide fixation in a microalga. *Plant, Cell & Environ.* <https://doi.org/10.1111/pce.13674>
78. Schreiber, I., Hesse, B., Seim, C., **Castillo-Michel, H.**, Anklamm, L., Villanova, J., Dreiaek, N., Lagrange, A., Penning, R., De Cuyper, C., Tucoulou, R., Baumler, W., Cotte, M., Luch, A., (2019) Distribution of nickel and chromium containing particles from tattoo needle wear in humans and its possible impact on allergic reactions *Particle and Fibre toxicol.* <http://dx.doi.org/10.1186/s12989-019-0317-1>
77. Lehmann, S., Toybou, D., Pradas del Real, A.E., Arndt, D., Tagmount, A., Viau, M., Safi, M., Pacureanu, A., Cloetens, P., Bohic, S., Salomé, M., **Castillo-Michel, H.**, Omaña-Sanz, B., Hofmann, A., Vulpe, C., Simonato, J.P., Celle, C., Charlet, L., Gilbert, B., (2019) Crumpling of silver nanowires by endolysosomes strongly reduces toxicity. *PNAS* <https://doi.org/10.1073/pnas.1820041116>
76. Veronesi, G., Moros, M., **Castillo-Michel, H.**, Mattera, L., Onorato, G., Wegner, D., Ling, W.L., Reiss, P., Tortiglione, C., (2019) In vivo biotransformations of indium phosphide quantum dots revealed by X-ray micro-spectroscopy. *ACS Appl. Mater. Interfaces*, <https://doi.org/10.1021/acsami.9b15433>
75. Morrell, A.P., Floyd, H., Mosselmans, J.F., Grover, L.M., **Castillo-Michel, H.**, Davis, E.T., Parker, J.E., Martin, R.A., Addison, O. (2019) Improving our understanding of metal implant failures: Multiscale chemical imaging of exogenous metals in ex-vivo biological tissues. *Acta Biomaterialia*, <https://doi.org/10.1016/j.actbio.2019.05.071>
74. Rivard, C., Amenc, L., Benlahrach, S., Makoudi, B., Teffahi, M., **Castillo-Michel, H.**, Cotte, M., Lassalle-Kaiser, B., Drevon, J. (2019) *Protoplasma*, <https://doi.org/10.1007/s00709-019-01360-8>
73. Ibeas M.A., Grant-Grant, S., Coronas, M.F., Vargas-Perez, J.I., Navarro, N., Abreu, I., **Castillo-Michel, H.**, Avalos-Cembrano, N., Paez-Valencia, J., Perez, F., Gonzalez-Guerrero, M., Roschztardt, H. (2019) The diverse Iron distribution in Eudicotyledoneae seeds: From arabidopsis to quinoa. *Frontiers in Plant Science* <https://doi.org/10.3389/fpls.2018.01985>
72. Bakshi, M., Line, C., Bedolla, D.E., Stein, R., Kaegi, R., Sarret, G., Pradas del Real, A.E., **Castillo-Michel, H.**, Abhilash, P.C., Larue, C. (2019) Assessing the impacts of sewage sludge amendment containing nano-TiO₂ on tomato plants: A life cycle study. *Journal of Hazardous Materials*, <https://doi.org/10.1016/j.jhazmat.2019.02.036>

2018

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70. Morell, A., Addison, O., Mosselmans, J.F., Geraki, K., Ignatyev, K., **Castillo-Michel, H.**, Monksfield, P., Warfield, A., Febbraio, M., Roberts, H., Martin, R., (2018) The implications of X-ray beam profiles on qualitative and quantitative synchrotron micro-focus X-ray fluorescence microscopy. *Journal of Synchrotron Radiation*, <https://doi.org/10.1107/S160057751801247X>
69. Legorreta-Flores, A., Davila-Tejada, A., Velásquez-González, O., Ortega, E., Ponce, A., **Castillo-Michel, H.**, Reyes-Grajeda, J.P., Hernández-Rivera, R., Cuéllar-Cruz, M., Moreno, A. (2018) Calcium carbonate crystal

shapes mediated by intramineral proteins from eggshells of ratite birds and crocodiles. Implications to the eggshell's formation of a dinosaur of 70 million years old. *Crystal Growth & Design*, DOI:

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67. Pongrac, P., Serra, T., Castillo-Michel, H., Vogel-Mikus, K., Arcon, I., Kelemen, M., Jencic, B., Kavcic, A., Villafort-Carvalho, M.T., Aarts, M. (2018) Cadmium associates with oxalate in calcium oxalate crystals and competes with calcium for translocation to stems in the cadmium bioindicator *Gomphrena claussenii*. *Metallomics*, DOI: 10.1039/C8MT00149A

66. Grigoruta, M., Vargas-Caraveo, A., Vazquez-Mayorga, E., **Castillo-Michel, H.**, Diaz-Sanchez, A., Reyes-Herrera, J., Martinez-Martinez, A. (2018) Blood mononuclear cells as speculum of emotional stress analyzed by synchrotron technology and a nootropic drug. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 204, 475-483.

65. Krauze, D.M., Grzelak, Wrobel, P., Veronesi, G., **Castillo-Michel, H.**, Chmura, L., Adamek, D., Jach, R., Lankosz, M., (2018) Investigation of the iron oxidation state in ovarian cancer using synchrotron micro X-ray absorption near edge structure- preliminary results. *Journal of analytical atomic spectrometry*. DOI:

[10.1039/C8JA00140E](https://doi.org/10.1039/C8JA00140E)

64. Pradas del Real, A.E., **Castillo-Michel, H.**, Kaegi, R., Larue, C., de Nolf, W., Reyes-Herrera, J., Tucoulou, R., Sarret G. (2018) Searching for relevant criteria to distinguish natural vs. anthropogenic TiO₂ nanoparticles in soils. *Environmental Science: Nano*, <http://dx.doi.org/10.1039/C8EN00386F>

63. Molina-Guerrero, C.E., de la Rosa, G., Castillo-Michel, H., Sánchez, A., García-Castañeda, C., Hernández-Rayas, A., Valdez-Vazquez, I., Suarez-Vázquez, S. (2018) Physicochemical Characterization of Wheat Straw during a Continuous Pretreatment Process. *Chemical Engineering and Technology*, <https://doi.org/10.1002/ceat.201800107>.

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61. Eymard-Vernain, E., Lelong, C., Pradas del Real, A.E., Soulas, R., Bureau, S., Tardillo-Suarez, V., Gallet, B., Proux, O., **Castillo-Michel, H.**, Sarret, G. (2018) Impact of a model soil microorganism and of its secretome on the fate of silver nanoparticles. *Environmental Science and Technology*, 52, 71-78.

60. Servin, A., **Castillo-Michel, H.**, Hernandez-Viezcás, J., De Nolf, W., De La Torre Roche, R., Pagano, L., Pignatello, J., Uchimiya, M., Gardea-Torresdey, J., White, J. (2018) Bioaccumulation of CeO₂ nanoparticles by earthworms in biochar amended soil: A Synchrotron Microspectroscopy Study. *Journal of Agricultural and Food Chemistry*, DOI: 10.1021/acs.jafc.7b04612

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2017

58. Schreiber, I., Hesse, B., Seim, C., **Castillo-Michel, H.**, Villanova, J., Laux, P., Dreijack, N., Penning, R., Tucoulou, R., Cotte, M., Luch, A. (2017) Synchrotron-based nano-XRF mapping and μ -FTIR microscopy enable to look into the fate and effects of tattoo pigments in human skin. *Scientific Reports*, 7, 11395.

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55. Dauphin, Y., **Castillo-Michel, H.**, Denys, C., El Hajraoui, M. A., Nespoulet, R., Stoetzel, E. (2017) Diagenetic alterations of *Meriones* incisors (Rodentia) of El Harhoura 2 cave, Morocco (late Pleistocene-middle Holocene). *Palz*, doi:[10.1007/s12542-017-0382-4](https://doi.org/10.1007/s12542-017-0382-4).

54. Pradas del Real, A.E., Vidal, V., Carrière, M., **Castillo-Michel, H.**, Levard, C., Chaurand, P., Sarret, G. (2017) Silver nanoparticles and wheat roots: A complex interplay. *Environmental Science and Technology*, 51 (10), 5774-5782. DOI: 10.1021/acs.est.7b00422

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51. Servin, A.D., Pagano, L., **Castillo-Michel, H.**, De la Torre-Roche, R., Hawthorne, J., Hernandez-Viezcas, J.A., Loredó-Portales, R., Majumdar, S., Gardea-Torresdey, J.L., Dhankher, O.M., White, J.C. (2017) Weathering in soil increases nanoparticle CuO bioaccumulation within a terrestrial food chain. *Nanotoxicology*, 11(1), 98-111.
50. Loredó-Portales, R., **Castillo-Michel, H.**, Aquilanti, G., De La Rosa-Álvarez, G., Rocha-Amador, D.O., Vogel-Mikus, K., Kump, P., Cruz-Jiménez, G. (2017) Synchrotron based study of As mobility and speciation in tailings from a mining site in Mexico. *Journal of Environmental Chemical Engineering*, 5 (1), 1140-1149.
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45. **Castillo-Michel, H.**, Larue, C., Pradas del Real, A., Cotte, M., Sarret, G. (2016) Practical Review on the use of synchrotron based micro- and nano- X-ray fluorescence mapping and X-ray absorption spectroscopy to investigate the interactions between plants and engineered nanomaterials. *Plant physiology and biochemistry* (<http://dx.doi.org/10.1016/j.plaphy.2016.07.018>)
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2015

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characterization of Ag NPs and determination of dissolved Ag in human plasma and blood burnt patients. *Analytical and bioanalytical Chemistry*, 408(19), 5109-5124.

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